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This guide presents information concerned with the planning of areas and facilities for athletics, recreation, outdoor education, and physical and health education. Swimming pools, service areas, ice skating, field houses, arenas, and stadiums are among the many facilities which are considered. Included are many diagrams and sketches giving specific measurements. A check list is provided. (FS)

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FACILITIES GUIDE

**FOR HEALTH, PHYSICAL EDUCATION
RECREATION AND ATHLETICS**

**Participants in the
Fourth National Facilities Conference**

1968

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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FOREWORD

At a meeting of the Board of Directors of the American Association for Health, Physical Education, and Recreation, held in Washington, D.C., in April 1945, favorable action was taken on a proposal by Caswell M. Miles, AAHPER Vice-President for Recreation, that a grant of money be obtained to finance a national conference on facilities. Subsequently, a request for \$10,000 to finance the first facilities workshop was placed before Theodore P. Bank, President of The Athletic Institute. At a later meeting of the Board of Directors of The Athletic Institute, the project was approved and the money appropriated to finance the first workshop.

The National Conference on Facilities for Health, Physical Education, and Recreation was formed for the purpose of organizing and conducting the workshop. The members of the Conference Executive Committee included representatives of the several national organizations cosponsoring the project.

Over 20 years have elapsed since the printing of the **Guide** which resulted from the first workshop, held at Jackson's Mill, West Virginia, in December 1946. During this interval, there have been 12 printings of the **Guide**.

The second workshop was held May 5-12, 1956, at the Kellogg Center for Continuing Education, Michigan State University, East Lansing. The second workshop, as was the first, was financed by The Athletic Institute. The 1956 edition of the **Guide**, which resulted from the second workshop, has been widely used in the planning and construction of facilities.

The third workshop, which was financed jointly by AAHPER and The Athletic Institute, was held January 15-24, 1965, at the Biddle Continuing Education Center, Indiana University, Bloomington. The 1965 edition of the **Guide**, which was prepared by the third workshop, has been well received throughout the country.

During recent years, there have been many new developments in facility planning and construction. These developments have been due to a number of factors. The need for improving education, recreation, and fitness opportunities for the youth of the nation has been highlighted by many groups. The fine work of the President's Council on Physical Fitness is one illustration of the growing national interest in health, physical education, and recreation activities. Much of the research and attention devoted to facility planning and construction during the past 25 years has been due to the increased leisure time in our society and a growing realization of the concept that recreation, and especially physical activity, is a fundamental human need essential to the well-being of all people.

At the 1965 facilities workshop, there was an expressed interest in the need for a **Guide** on college facilities. It was pointed out that the earlier **Guides** had been directed toward community and school use. Although some attention was

given to basic college needs by those attending the 1965 workshop, the participants agreed that a college and university **Guide** should be prepared at a subsequent workshop. As a result, AAHPER and The Athletic Institute again agreed to finance such a project and the dates of April 29-May 8, 1967, were set for the fourth workshop.

The delegates for the 1967 workshop were carefully selected on the basis of their particular knowledge and contributions. Among those invited were a number of outstanding college and technical personnel engaged in planning and conducting programs of athletics, recreation, outdoor education, and physical and health education. In addition, invitations were extended to a number of specialists responsible for planning and constructing facilities for these programs. These specialists included city planners, architects, landscape architects, engineers, and schoolhouse construction consultants.

Early in the planning, chairmen were selected for the various workshop committees. These committees were busily engaged in conducting research and gathering data prior to the workshop, which was again held at the Biddle Continuing Education Center at Indiana University.

The workshop participants approached the task of preparing the new **Guide** from the standpoint that adequate programs of athletics, recreation, outdoor education, and physical and health education can be provided only through cooperative planning directed toward the most economical and efficient use of the total resources. Every effort was made to incorporate the most recent advances in facility planning and construction. At the same time, an attempt was made to identify new needs and to anticipate future ones.

Appreciation is extended to all those who contributed their time, effort, and materials to make this **Guide** possible. It has been a team project, and, therefore, the publication does not necessarily represent the viewpoint of any one individual or the organization he represents. It is a composite of the thinking and effort of the entire group of workshop participants and preworkshop committee members.

This **Guide** is an answer to a great need for concrete information that would be of material value to planners of areas and facilities for athletics, recreation, outdoor education, and physical and health education. Not only does it include many diagrams and sketches showing specific measurements, but it provides a check list to prevent the inadvertent omission of an item that would be difficult to correct later. The fact that it is essentially functional and complete is a credit to those who have prepared this document. It should be in the hands of every department head, architect, planning consultant, and all others who may either be interested in planning new college or university facilities for health, physical education, and/or recreation, or checking the adequacy of those already in use.

Chapter 1

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PROGRAM OBJECTIVES AND NEEDS

Human needs and educational objectives determine the program content in health and safety education, physical education, recreation, and athletics. The program content, in turn, will be the basis for determining facility needs. Since no two institutions will have identical programs, the facility requirements will vary among colleges and universities. These facilities require detailed planning by responsible persons to assure that they are functional.

Health and safety education, physical education, recreation, and athletic facilities provide the laboratories necessary for the accomplishment of program objectives. Therefore, the program content must be continuously considered throughout the planning process.

BASIC OBJECTIVES

Before considering the planning of areas and facilities essential for health and safety education, physical education, recreation, and athletics, it is important to understand the basic aims and objectives of these fields.

PHYSICAL EDUCATION¹

The aim of physical education is to help people of all ages live healthy, satisfying, and energetic lives. Four specific purposes are: to develop and maintain maximum physical efficiency; to develop useful knowledge and physical skills; to act in socially-useful ways; and to enjoy wholesome physical recreation.

The subject matter of physical education is the science and skill of movement. All types of sports and other physical activities are utilized to develop in youth and adults the strength, endurance, coordination, and flexibility essential in both work and play.

Through physical education, boys and girls, youth, and adults are: (1) taught the physical skills needed for performing their daily work; (2) trained and conditioned for the maintenance of mental and physical health; and (3) helped to acquire the skills of those physical activities which may be enjoyed during their leisure time throughout life.

A sound college or university physical education program includes: required daily participation—by all students—in appropriate and diversified physical activities; and a wide variety of intramural activities available to all. Additional opportunities should be provided for those of superior ability to participate in their areas of special interest, such as sports, gymnastics, swimming, and dance.

HEALTH AND SAFETY EDUCATION

The aim of health and safety education is to provide experiences which will favorably influence knowledge, attitudes, habits, and practices related to individual, community, and world health and safety.

¹ This section is adapted from a statement issued by the American Association for Health, Physical Education, and Recreation.

Health and safety education seeks to bridge the gap between scientific knowledge of health and safety and its application by people in their daily lives. A college or university health and safety education program includes healthful living, health and safety instruction, and health services.

RECREATION

The primary function of recreation is the enrichment of living by enabling individuals to find outlets for self-expression and thereby to develop their inherent potential and achieve desired satisfactions. These satisfactions include adventure, fellowship, a sense of accomplishment, the enjoyment of beauty, and the joy of creating, all of which contribute to human happiness. Through recreation programs, people are helped to develop interests and skills which enable them to make constructive use of leisure, and which contribute to physical and mental health, safety, good citizenship, confidence, and character development.

Recreation is essentially a kind of experience rather than a set of specific activities. Many types of these experiences have a major place in college and university programs. The wide range of recreation activities includes games and sports, music, dance, arts and crafts, drama, social activities, nature and outing activities, hobbies, and service projects. The comprehensive recreation program affords the students, faculty, and staff the opportunity to engage in a variety of activities with the help of trained leaders and under conditions which assure maximum enjoyment and benefits.

ATHLETICS

The intercollegiate or extramural athletic programs of a college or university are designed to meet the needs of those men and women who have attained a high degree of proficiency in sports activities. These athletic programs should be broad in scope, and, ideally, should provide opportunities for participation in all competitive sports.

NEED FOR PROGRAMS

Man functions as a total organism. Experience and learning leave their impression upon his totality. They make changes in his mental and physical being, and in his emotional and social attitudes.

Down through the ages, man has adapted himself to his environment very well. Otherwise, he would have been extinct like many prehistoric animals. Modern man, however, faces a more rapidly changing environment than his forefathers, and today's college students will find it increasingly more difficult to adapt to the new social conditions. The impact of less physical activity, more leisure time, inditing advertisements, confusing propaganda, conflicting ideologies, and everyday threats of disasters and wars confronts today's students with myriads of mental, physical, emotional, and social strains. These can be most effectively discussed and alleviated in the educational climate of the campus.

PROGRAM OBJECTIVES AND NEEDS

The fragmentation of campus life caused by the location of an increasing percentage of the college population in urban-centered institutions has resulted in an increased proportion of off-campus housing. This situation has become a serious problem in the United States. An increasing number of requests are being received by college administrators for the development of facilities which will cause the commuter student to want to remain on the campus for longer periods of time. Physical education and recreation facilities are frequently mentioned as primary contributors to the solution of this problem.

It is apparent that one of the solutions to the problems of adjusting to a rapidly-changing society is proper preparedness through education. For fruitful and purposeful living, man must be an active participant in educational and recreational endeavors and experiences. A broad instructional program is essential at the college or university level if students are to be better prepared to cope with their recreation needs throughout life. However, even with a broad program of instruction, the student must be given the opportunity to participate in a wide range of physical recreation activities in order that he can supplement his class learning experiences with both out-of-class practice of activities and exposure to numerous new activities. The college years provide the last opportunity to expose the student to physical recreation activities within the framework of the college or university.

NEED FOR AREAS AND FACILITIES

Most colleges and universities have, in recent years, been under great pressure to expand their facilities in order to meet program needs. Enrollments are rapidly rising because of a growing population and because an ever-increasing percentage of the population is seeking a college education. In addition, program advancement, enrichment, diversification, and specialization are contributing to a greater need for health and safety education, physical education, recreation, and athletic facilities. Since the growth of existing institutions will be unable to meet these pressures, new college and university campuses are being planned throughout the country.

The community college program is rapidly growing in most of the urban areas. Educators are in general agree-

ment that the future role of the community college will be to provide the first two, and, in some instances, the first four years of the college education to the vast majority of students. The large university will then be made up almost entirely of upper-level undergraduate and graduate students.

The community college will have to assume the important responsibility for providing physical education and recreation programs that will enable students to live as a total being throughout life. Therefore, it is essential that the community college plan facilities which will enable it to meet this responsibility. It is equally important that the large university provide opportunities for continued participation in the activities learned during the earlier college years.

NEED FOR PLANNING

Those institutions with foresighted leadership grow in accordance with a master plan designed by professional planners. The existence of a master plan, however, is not a permanent solution. The plan should be reviewed periodically and modified according to changing needs. The expert planner is capable, in most situations, of planning with respect for the dynamics of a changing situation. The avoidance of becoming hampered by too much rigidity, and, at the same time, meeting realistic needs during each year of growth is the essence of master planning for a college.

Professional planners cannot work successfully without the counsel of program specialists from all disciplines involved. It is especially important that program specialists assisting in the planning of facilities for health and safety education, physical education, recreation, and athletics be highly qualified to serve as consultants. Since most college and university planning will have some effect upon these fields, it is important that these areas be represented in all campus planning discussions.

Since the faculty in most institutions is composed of specialists, an individual faculty member may be quite knowledgeable about a particular aspect of his field, but may, at the same, be largely unaware of the special needs of another area. Therefore, it is recommended that professionals in health and safety education, physical education, recreation, and athletics utilize source materials, such as this *Guide*, to help them in their consultant work with planners.

SELECTED REFERENCES

Crawford, Wayne H., *A Guide for Planning Indoor Facilities for College Physical Education*. New York: Bureau of Publications, Teachers College, Columbia University, 1963.

Engelhardt, N. L.; Engelhardt, N. L., Jr.; and Leggett, Stanton, *School Planning and Building Handbook*. New York: F. W. Dodge Corporation, 1956.

Gabrielsen, M. A., and Miles, C. M., *Sports and Recreation Facilities for School and Community*. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1958.

Participants in National Facilities Conference, *Planning Areas and Facilities for Health, Physical Education, and Recreation*. Chicago: The Athletic Institute, and American Association for Health, Physical Education, and Recreation (NEA), 1965.

Scott, Harry A., and Westkaemper, Richard B., *From Program to Facilities in Physical Education*. New York: Harper and Brothers, 1958.

Chapter 2

BASIC PLANNING PRINCIPLES

Acceptance of the thesis that health and safety education, physical education, recreation, and athletic programs are essential to present-day living, and of even greater importance to the future well-being and happiness of people, makes it logical to state the principles basic to planning areas and facilities for these programs.

PRINCIPLES

The principles listed in this chapter are based upon certain assumptions. One of these is that health and safety education, physical education, recreation, and athletics provide important educational experiences for all students. Furthermore, intramural activities and recreation opportunities should be provided at times during the day when students, faculty, and staff desire to participate. Finally, facilities should be provided for the comfort of those spectators who wish to attend athletic contests.

- **Good facilities are essential to a satisfactory program in health and safety education, physical education, recreation, and athletics.** Facilities should be provided to meet all the requirements of those activities which go to make up a comprehensive program of health and safety education, physical education, recreation, and athletics. Initial planning should point toward a realistic but ideal situation. The real needs, as seen by the program specialists, should be the basis for planning.

- **All planning should be within the scope of a master plan for the institution.** In planning such facilities as swimming pools, athletic fields, and gymnasiums, consideration should be given to the space and financial needs of the institution as a whole. It is imperative that those responsible for health and safety education, physical education, recreation, and athletic programs play an important part in all campus planning.

- **The type, location, and dimensions of areas and facilities planned should be related to existing facilities of all kinds.** In planning spaces for particular activities, consideration should be given to the kinds of programs for which the space is best designed. When designing a facility, consideration should be given to efficient and functional use, keeping in mind possibilities for flexibility, expansibility, and adaptability.

- **All planning should conform to state and local regulations and accepted standards.** Planning groups should be familiar with state and local fire, building, electrical, and sanitary codes.

- **Planning should include provision for the needs of the atypical.** Recent advancements in knowledge and technology have resulted in more individuals with disabilities being motivated to attend college. More institutions each year are extending themselves to make a college education possible for all qualified and deserving people. The development and implications of "continuing education" add further significance to the need and desirability of designing college facilities for everyone, including the disabled and the aging (see Appendix G).

- **All interested and qualified individuals and groups should be given an opportunity to share in the planning.** Every individual or group wishing to make suggestions should have the opportunity to do so. Sometimes an excellent idea comes from a most unlikely source. Inviting all interested parties to contribute will make it necessary to screen and sift much material, but no interested person should be denied the opportunity to participate. This approach creates *esprit de corps* and the accompanying good will.

- **Initial planning should be pointed at the ideal.** Realism should not be forgotten in planning ideal facilities. Planners should "think big" without indulging in dreams completely out of line with the needs of the program. The realistic needs of the program should be the focus of all early planning.

- **A professional consultant in planning health and safety education, physical education, recreation, and athletic facilities should be retained.** The professional consultant is concerned with problems related to function, size, and relationships. His specialized knowledge, based upon study and experience, should be most helpful in aiding the professional to determine what he needs. In addition, he aids in translating these needs to the architect, and this helps the architect to build a truly functional and practical facility. The use of a professional consultant should save money on the original cost of the building, and improve maintenance and operating efficiency.

- **Every available source of funds should be investigated.** Sources of information regarding available funds from the federal government and private and public foundations include state universities, federal agencies, and state departments of education.

- **Professionals must be constantly aware of future needs and must continuously investigate the possibility of obtaining new spaces.** Most colleges and universities are growing rapidly with regard to enrollment and physical plant. Open space is becoming increasingly more difficult to obtain and retain. Professionals must plan ahead so as to make their future needs known before all campus and off-campus land is allocated. They must point out the necessity for retaining that space which is now being used for health and safety education, physical education, recreation, and athletics.

- **Planning functions should be carefully organized.** A number of organizational patterns have been successfully used. A common plan that works well is as follows:

1. A professional planning office
2. A campus planning committee
3. A project planning committee
4. Program specialist subcommittees

The first two are usually part of the regular college or university planning program. The third is an *ad hoc* group, composed of program specialists, established for the purpose of programming new construction for a specific discipline. The project planning committee for a new

field house, for example, will consist of program specialists in health and safety education, physical education, recreation, and athletics. Professional planners and architects must work closely with program specialists in order that they may be constantly aware of the objectives which the construction of the facility attempts to attain. Several project planning committees may be at work at the same time. These are *ad hoc* committees which are disbanded when their assignment has been completed.

A building should be programmed by the specialists and such programming should include a description of the sizes, functions, and relationships of the facilities desired. Schematic drawings should be prepared by this group. The architect can then graphically interpret the thinking of the group and submit these drawings for re-study by the program specialists and/or project planning group. Figure 1 is an organization chart showing the interrelationships of the various planning groups.

DETERMINING FACILITY NEEDS

Since the program is the basis for facility planning, the facilities should be designed to meet the needs of the program. The following are questions to assist program specialists in determining their facility needs:

- **How many years of instruction in physical education will be required of all students?** Studies indicate that in colleges and universities requiring all students to take physical education for three years or more, the peak loads on facilities occur during class hours. Conversely, in those institutions requiring from one to two years of basic instruction in physical education, the peak load occurs after school hours.

The peak load is a factor in determining the types of facilities needed and the square footage and numbers of units of each type. The futility of dropping required physical education in the belief that this will reduce the pressures on facilities for physical education and athletics is obvious. In fact, the elimination of a physical education

requirement may increase the demands for this type of space, since all students will then tend to use after-school hours to meet their physical-activity needs. This concentration of student activity into a shorter daily period will likely make it necessary to provide greater play and exercise space than needed for a balanced program of basic instruction, free-play opportunities, and intramural and intercollegiate sports competition.

The erroneous practice of dropping required physical education in order to eliminate the need for physical-activity spaces has been pointed out. Even more important, however, are the effects of such a decision on the entire life of the student. The psychological pressures present in today's society are so intense that man must have wholesome recreative experiences in order to survive. Prior to the "age of automation," man often found his creative needs fulfilled through his work, but increasing numbers of people today feel an emptiness in life which can be filled only through leisure-time recreative experiences.

A college or university should dedicate itself to the education of the total man. To do otherwise will only lead to increased frustration and emotional disturbance. The cost of total education for life is far less than the cost of curing the emotional illnesses of those who were not properly prepared for life. Society cannot afford the luxury of allowing colleges and universities to educate only a part of the man. And students should demand that educational leaders be foresighted enough to prepare them properly for life in a complex and technical society.

- **Is the instructional physical education program to be broad in scope, with opportunities for the development of interests and skills in a great variety of sports?** The objectives of physical education as envisioned by the administration must be taken into consideration. Broad views of this area of education with multiple objectives should be planned. This will result in a need for more elaborate facilities than would be needed if a limited program were planned.

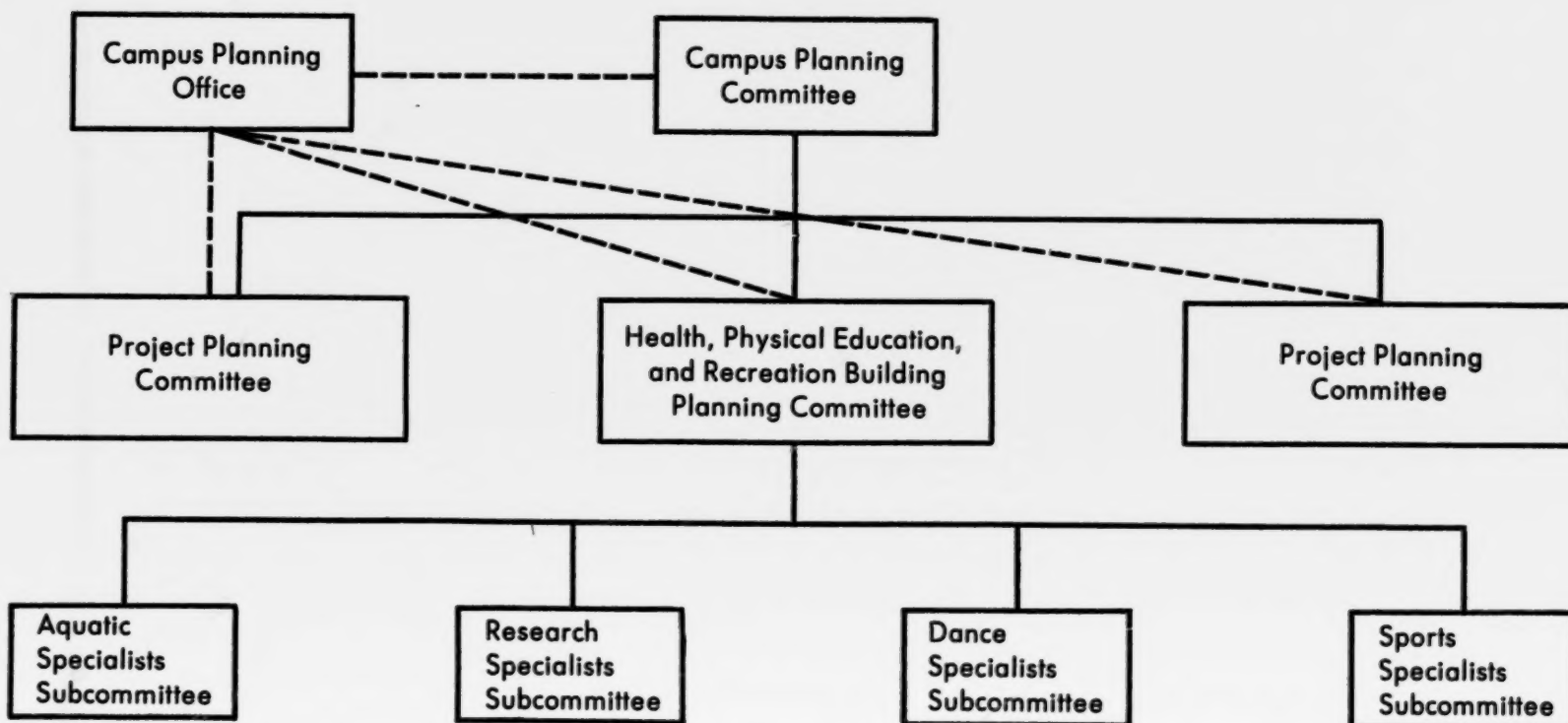


Figure 1
Campus Facility Planning Organization Chart

● **Are professional curriculums in health and safety education, physical education, and recreation to be a part of the program?** The specific kinds of facilities needed will be somewhat different if the program is entirely basic instruction and intramural and intercollegiate athletics. More lecture rooms, seminar areas, and office space will be required in college and university departments offering professional curriculums. Departments which offer graduate programs will need facilities such as research laboratories to provide the graduate student opportunities implicit in graduate education.

● **What responsibility does the college or university take for the physical recreation and physical fitness of its faculty and staff?** Good faculty members are difficult to recruit and more difficult to keep. Many colleges are encouraging their faculty to use the gymnasium and sports fields for recreation and fitness. There is some evidence that fringe benefits of this type are important in maintaining a good and also healthy faculty. The interest of this group should be a consideration in planning. Faculty interests seem to be strong in such activities as handball, squash, tennis, golf, badminton, swimming, weight training, and running. Consideration for the welfare of faculty and staff will indicate a need for more facilities in the areas of their particular interests.

● **Will research in health and safety, physical education, recreation, and athletics be an aspect of the professional program?** If so, research laboratory space must be provided. The square footage and room dimensions for research laboratories will vary considerably, depending upon the kinds of research to be conducted.

● **What will be the scope of the intercollegiate and extramural athletic programs?** Women's extramural activities and varsity athletics should provide for the competitive interests and abilities of the highly-skilled students.

● **What will be the scope of the intramural sports program?** The intramural program should include activities for all men and women. The program should be varied so as to provide for all interests and levels of ability. Both the competitive and the recreation needs should be served.

● **What are the environmental factors which will affect the program and facilities for the college or university?** Environmental factors such as climate, population, space availability, topographical features, campus plan relationships, and transportation must be considered. The planner might need to devote special attention to the question of whether facilities are to be centralized or decentralized. He should be aware of the current concept of the residential college.

SELECTED REFERENCES

Crawford, Wayne H., *A Guide for Planning Indoor Facilities for College Physical Education*. New York: Bureau of Publications, Teachers College, Columbia University, 1963.

Engelhardt, N. L.; Engelhardt, N. L., Jr.; and Leggett, Stanton, *School Planning and Building Handbook*. New York: F. W. Dodge Corporation, 1956.

Gabrielsen, M. A., and Miles, C. M., *Sports and Recreation Facilities for School and Community*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1958.

Participants in National Facilities Conference, *Planning Areas and Facilities for Health, Physical Education, and Recreation*. Chicago: The Athletic Institute, and American Association for Health, Physical Education, and Recreation (NEA), 1965.

Scott, Harry A., and Westkaemper, Richard B., *From Program to Facilities in Physical Education*. New York: Harper and Brothers, 1958.

Chapter 3

GUIDE LINES TO PLANNING

The colleges and universities of the United States are facing the greatest decade of expansion in history. Predictions indicate that these institutions will have to build as many new buildings in the next ten years as they have constructed during the past 300 years. The magnitude of this problem has made the development of a master plan essential to college development.

SPACE STANDARDS

Planning officials in colleges and universities need guide lines in terms of square feet per student for the development of the master plan for the campus. Unless land is set aside for both indoor and outdoor facilities, keeping in mind the long-range growth of the institution, an impasse is eventually reached where it becomes impossible to administer an adequate program of physical education, recreation, and athletics.

The suggested standards which follow have been adapted from a planning study completed by Sabora and Kenney at the University of Illinois. These standards are based on the makeup of the student population of the institution (Applied Student Population).

It is recommended that the following formula be used for determining the **Applied Student Population**: Total undergraduate enrollment plus 30 percent of graduate enrollment equals **Applied Student Population**.

TYPE "A" — Indoor Activity Stations

Space requirements: 12 square feet per student (**Applied Student Population**)

Including: Gym floor, mat areas, swimming pools, courts, etc. (adjacent to lockers and showers and within ten-minute walking distance of academic classrooms)

Uses: Physical education class instruction, varsity sports, intramural sports, informal sports participation, student and faculty recreation, etc.

Breakdown of Type "A" Space

- A1 - Large gymnasium areas with relatively high ceilings (22 feet minimum) for basketball, badminton, gymnastics, apparatus, volleyball, etc. (approximately 55 percent of the computed Type "A" space)
- A2 - Activity areas with relatively low ceilings (12 feet minimum) for combatives, therapeutic exercises, dancing, weight lifting, etc. (approximately 30 percent of the computed Type "A" space)
- A3 - Swimming and diving pools (approximately 15 percent of the computed Type "A" space)
- A4 - Handball and squash courts. In addition to the above requirements, there should be one handball or squash court for each 800 students (**Applied Student Population**).

TYPE "B" — Outdoor Activity Stations

Space requirements: 100 square feet per student (**Applied Student Population**)

Including: Sports fields of all types (adjacent to lockers and showers and within ten-minute walking distance of academic classrooms)

Uses: Physical education class instruction, varsity sports, intramural sports participation, student and faculty recreation, etc.

Breakdown of Type "B" Space

- B1 - Sodded areas for soccer, touch football, softball, etc. (approximately 60 percent of the computed Type "B" space)
- B2 - Court-type areas for tennis, volleyball, flicker ball, etc. (approximately 15 percent of the computed Type "B" space). There should be one doubles tennis court for each 400 students (**Applied Student Population**).
- B3 - Specialized athletic areas for track and field, baseball, archery, varsity football, golf, camping demonstrations, etc. (approximately 25 percent of the computed Type "B" space)
- B4 - Swimming pools (included in B3 approximation)

TYPE "C" — Sports Fields and Buildings; Intramural and General Outdoor Recreation Areas

Space requirements: 160 square feet per student (**Applied Student Population**)

Including: Playing fields and athletic buildings of all types: softball diamonds, tennis courts, arenas, field houses, etc. (too far removed from general student lockers, showers, living quarters, and academic buildings for use as teaching stations) (maximum distance from major residence areas: one mile)

Uses: Intramural sports, varsity sports, informal sports

Breakdown of Type "C" Space

- C1 - Sodded areas for soccer, touch football, softball, etc. (approximately 40 percent of the computed Type "C" space)
- C2 - Court-type areas for tennis, volleyball, flicker ball, etc. (approximately 10 percent of the computed Type "C" space)
- C3 - Specialized athletic areas for track and field, baseball, archery, varsity football, golf, camping demonstrations, etc. (approximately 45 percent of the computed Type "C" space)
- C4 - Swimming pools (included in C3 approximation)
- C5 - Sports and intramural buildings providing lockers, showers, play space, office space, lounge rooms, etc. (approximately 5 percent of Type "C" space)

TYPE "D" — Informal Recreation Areas

Space requirements: Included in C3

Including: On-campus picnic areas (maximum distance

from residence areas: 1-1/2 miles) (approximately 14 percent of total Type "C" space)

Uses: Overnight camping, picnics, outing activities, camping demonstrations, golf, archery, boating, canoeing, outdoor swimming, etc.

TYPE "E" — Off-campus Outdoor Education, Camping, and Recreation Areas

Including: Outdoor camping and outdoor education center, off-campus golf course, university country club, etc. (maximum distance from heart of campus: 25 miles)

Uses: Overnight camping, picnics, outing activities, camping demonstrations, golf, archery, boating, canoeing, outdoor swimming, etc.

Estimate of space needs of this type area: It is difficult to state these needs on a square-feet-per-student basis. Such areas contribute materially to the outdoor education and outdoor recreation of both men and women students, but the many variables in climate, topography, distance from the heart of the campus, and emphasis on outdoor education make a square-feet-per-student standard difficult to establish. One acre per student for the anticipated enrollment is generally recommended for an outdoor education laboratory.

Table 1 is a sample chart for evaluating the facilities of a college or university having a total undergraduate and graduate enrollment of 13,000.

ANCILLARY AREAS

Research studies have indicated that a reasonable standard for determining the space needed for lockers, showers, towel rooms, equipment storage, supply rooms, and offices associated with Type "A" space is a square footage equaling approximately 35 percent of the activity area in a gymnasium facility.

The following is an example of how this standard may be used. Assume a building is being planned which will provide 100,000 square feet of activity area. In other words, the square footage in the swimming-pool surface and deck, and all gymnasium floors, including high- and low-ceiling areas, equals 100,000 square feet. This would mean that the square-footage needs for ancillary areas would be approximately 35,000 square feet. Architects generally speak of the combination of activity areas and ancillary areas in a gymnasium as "net usable area." Consequently, the net usable area in the building would be approximately 135,000 square feet.

TARE SPACE

All other than the net usable area in a building, including hallways, stairways, wall thicknesses, lobbies, public toilets, bleachers for public use, custodial space, and space needed for service conduits of all types, is referred to by many architects as "tare." The area needed for tare varies greatly from building to building, depending upon the function and architectural design. A rough estimate of the area needed for this item is a figure equal to 60 to 70 percent of the activity area in a gymnasium. If a large amount of permanent-type seating is provided in a building, the tare figure may be much higher. By adding tare, ancillary, and activity areas, an estimate of the gross square footage of a gymnasium building can be computed. This figure is helpful in preliminary discussions of costs.

The following is an example of the application of the formula mentioned above:

Activity Areas	100,000 sq. ft.
Ancillary Areas	35,000 sq. ft.
Net Usable Area	135,000 sq. ft.
Tare Areas	70,000 sq. ft.
Gross Area	205,000 sq. ft.

Another method of computing the gross building area is to start with the figure of net usable area (including activity areas, offices, locker and shower areas, storage space, supply rooms, and bleachers) and add 30 to 35 percent for circulation requirements (including public toilets, hallways, stairways, surge-lobby-areas, wall thicknesses, and mechanical areas). In a facility where most of the space is in the form of large open areas, the circulation area may be reduced to 20 to 30 percent. The area allotted for bleachers is highly variable, depending upon the intended function of the facility. In the following illustration of this formula, it was estimated that an area equal to 20 percent of the total activity area was devoted to permanent seating:

Net Usable Area	135,000 sq. ft.
plus seating	20,000 sq. ft.
Total	155,000 sq. ft.
multiplied by	33 1/3 percent
Circulation Area	51,667
Gross Area	206,667

APPLICATION OF STANDARDS

Standards are guides for the use of planning committees and administrators. Standards are extremely helpful to the planner but cannot be construed as a substitute for creativity. They help in early computations of cost estimates and also in checking preliminary drawings to determine whether enough space has been provided in different categories to meet the program needs of the student enrollment for which the facilities are planned.

Programs in colleges and universities vary all the way from a minimum service program in physical education to a broad program including teacher education, intramural sports, intercollegiate athletics, recreation education, health and safety education, and elaborate research relating to all of these areas. A comprehensive program calls for much more office space than a simple, required program for non-major students. The ancillary space provided by the 35-percent figure includes merely the minimum office requirement for physical education and athletics.

ENROLLMENT RELATIONSHIPS

When standards in terms of square feet per student are used as guides in college or university planning, it is natural to ask where the cutoff begins. At what point do the standards become meaningful? Obviously, for a college of 200 students, 12 square feet per student of indoor area for sports and athletics would be inadequate. It would not even provide one basketball court. A college or university with an enrollment of fewer than 3,000 undergraduate students should meet the minimum physical education-recreation space needs of an institution of 3,000. As a college or university increases in size above 3,000, the space standards outlined in this chapter are applicable.

THE PLANNING PROCESS¹

After it has been determined that additional facilities are needed, the following steps should be taken to ensure proper

¹ From N. L. Engelhardt, N. L. Engelhardt, Jr., and Stanton Leggett, *School Planning and Building Handbook*, F. W. Dodge Corporation, New York, 1956, pp. 125-126. Used by permission of McGraw-Hill Book Company.

GUIDELINES TO PLANNING

TABLE 1
FACILITIES EVALUATION CHART

Name of Institution: University of A
Undergraduate Student Enrollment: $11,500 \times 100\% = 11,500$
Graduate Student Enrollment: $1,500 \times 30\% = 450$
Applied Student Population: $= 11,950$

Type "A" Space Indoor Activity Stations National Standard: 12 sq. ft. per student x ASP ^a (11,950) = 143,000 sq. ft.						
Areas Measured	% of Class "A" Space	We have in sq. ft.	Standard in sq. ft.	% of Standard we have	% of Standard we need	Sq. ft. we need
A1 Gym A Gym B Gym C Gym D	55%	42,414	78,870	53.8%	46.2%	36,456
A2 Combatives Room Weight Room Correctives Room Dance Room	30%	10,135	43,020	23.6%	76.4%	32,885
A3 Swimming Pool	15%	2,925	21,510	13.6%	86.4%	18,585

Type "B" Space Outdoor Activity Stations National Standard: 100 sq. ft. per student x ASP ^a (11,950) = 1,195,000 sq. ft.						
Areas Measured	% of Class "B" Space	We have in sq. ft.	Standard in sq. ft.	% of Standard we have	% of Standard we need	Sq. ft. we need
B1 Soccer Field Flicker-ball Field General Fields	60%	435,600	717,000	60.7%	39.3%	281,400
B2 Tennis Courts Volleyball Courts Flicker-ball Courts	15%	28,360	179,250	15.8%	84.2%	150,890
B3 Track & Field Area Baseball Fields Football Fields	25%	1,207,680	298,750	100+%	0%	0

Type "C" Space Intramural Outdoor Recreation Areas National Standard: 160 sq. ft. per student x ASP ^a (11,950) = 1,912,000 sq. ft.						
Areas Measured	% of Class "C" Space	We have in sq. ft.	Standard in sq. ft.	% of Standard we have	% of Standard we need	Sq. ft. we need
C1 Soccer Fields Touch Football Fields Softball Fields	40%	270,894	764,800	35.4%	64.6%	493,906
C2 Tennis Courts Volleyball Courts Flicker-ball Courts	10%	52,720	191,200	27.5%	82.5%	138,480
C3 Football Fields & Track & Field Area C4 Baseball Fields Outdoor Pool	45%	1,163,052	860,400	100+%	0%	0
C5 Sports and Intramural Buildings	5%	0	95,600	0%	100%	95,600

Tennis Courts
Outdoor Activity Stations
(space included in Types B2 and C2 standards)
National Standard: $\frac{\text{one tennis court}}{400 \text{ students}} \times \text{ASP}^a (11,950) = 30 \text{ Tennis Courts}$

Areas Measured	Number we have	National Standard	% of Standard we have	% of Standard we need	Number we need
Tennis Courts	13	30	43.3%	56.7%	17

Handball and Squash Courts
Indoor Activity Stations
(space not included in Type A2 standard)
National Standard: $\frac{\text{one handball or squash court}}{800 \text{ students}} \times \text{ASP}^a (11,950) = 15 \text{ Handball or Squash Courts}$

Areas Measured	Number we have	National Standard	% of Standard we have	% of Standard we need	Number we need
Handball Courts Squash Courts	4	15	26.6%	73.4%	11

^aASP is the abbreviation for Applied Student Population.

planning and construction:

ANALYSIS AND CHARTING OF THE TOTAL PROJECT

The analysis and charting of the project will vary a great deal from one college or university to another, depending upon the planning organization already established within the institution. Presumably, the initiative will come from the program specialists, who must convince the administration of the need for new facilities. The Department of Health, Physical Education, and Recreation will undoubtedly wish to appoint a project planning committee. Some departments will have a regular building planning committee; others will appoint one of the staff members responsible for facilities coordination and planning, and will appoint a committee to work with him whenever a new project or building is being planned.

SELECTION OF A PROJECT PLANNING COMMITTEE

The Project Planning Committee should not be too large, but it should represent the various interests within the college or university who will be using, or who have an interest in the utilization of, the new facility. These people will be, for the most part, program specialists. When selecting this Committee, it should be kept in mind that many members of the faculty and others who will not be serving on the Committee can, and should, frequently be called upon to serve as consultants.

DOING THE SURVEY WORK WHICH WILL DEMONSTRATE THE NEED FOR NEW CONSTRUCTION

Survey work will be done by the Project Planning Committee of the Department. This survey should be carefully done because of the tremendous demand upon general budgets for funds. It must be proved conclusively that a new facility is needed before the administration can be expected to allocate funds for the project. The application of the planning standards outlined earlier in this chapter will reveal the need for additional facilities for the particular institution. This application should also be quite informative with respect to delineating present strengths and weaknesses of existing facilities, particularly in specific types of facilities (see Table 1). The Project Planning Committee for health, physical education, and recreation will need to do head-count and utilization surveys in different areas where activity is now taking place in order to demonstrate definitely that the present facilities are inadequate.

ARRIVING AT THE METHOD OF FINANCING THE PROJECT

Colleges and universities finance facilities in a number of different ways. New facilities and modifications of existing facilities may be financed by capital outlay funds, general budgets, student fees, federal or state grants, foundation grants, and/or private donations or gifts. The method of financing a particular facility is usually determined by the administration, which knows best the current possibilities for supporting the project.

ASSURING THAT ALL INTERESTED PARTIES ARE INVOLVED AT ALL STAGES

Each member of the faculty who wishes to be heard should be given a chance to contribute ideas, and to look over schematic drawings for improvement possibilities.

PROGRAMMING BY THE PROJECT PLANNING COMMITTEE WITH THE PARTICIPATION OF ALL OF THE FACULTY AND STAFF WHO ARE INTERESTED AND CAPABLE

It is recommended that the Project Planning Committee examine documents that have been prepared for building constructions of a similar type. Plans for these facilities can be provided by the college or university planning committee, the professional consultant, or an architect. If possible, the Committee should actually visit some of these facilities.

The programming of a building or a field should be completed in written form, with or without schematic drawings. Architects vary in their desire to have planning committees make and present such drawings. The architect normally prepares a great many preliminary schematic drawings in an effort to interpret the needs as represented by the Project Planning Committee.

SELECTION OF THE SITE OR SITES

The architect usually wants to be involved in site selection for a building. Many times, however, the site is selected prior to the appointment of an architect. Program specialists, engineers, and others should work together in the selection of a desirable site for any new construction. Some of the factors that must be considered in selecting a site are as follows:

- Proximity to classrooms
- Proximity to housing
- Pedestrian traffic patterns on the campus
- Motor traffic movement and parking space
- Soil conditions and drainage
- Availability of utilities
- Relationship to other health, physical education, recreation, and athletic facilities.

THE SELECTION OF AN ARCHITECT

Selecting an architect is a most significant action. It is of utmost importance that the firm selected shall have demonstrated its ability in planning buildings of the type under consideration. It is advisable for the Project Planning Committee to look at completed work of a similar type which was done by this architect. Evaluation should be made of the quality of the architect's staff, including an appraisal of the competence of the engineers, draftsmen, and artists:

The ability of the architect to write specifications, to provide good schematic drawings, to supervise construction, to balance between economy and function, to work with other people, and to be open to new ideas should be appraised carefully. Above all, the architect should have a reputation for honesty and integrity. The professional consultant retained by the Project Planning Committee should be extremely helpful in the selection of an architect.

ARRANGING FOR SCHEMATIC DRAWINGS, SKETCHES, AND BUILDING MODELS

Schematic drawings are sketches of floor plans for a building or field that are preliminary interpretations of the work of the program specialists in programming the facility. A designer will usually meet many times with the program specialists before he arrives at an interpretation of their ideas that is satisfactory to everybody involved in the planning. During this stage of planning, the architect will usually have someone draw a building model so that the program specialists and the Project Planning Committee can

GUIDE LINES TO PLANNING

see how the building fits in with its environment. They can draw conclusions from well-done building models concerning the aesthetic aspects of the building and the way in which it will blend with the campus in general.

REVIEWING THESE DRAWINGS AND SKETCHES BY THE PLANNING AND PROJECT COMMITTEES AND OTHERS ON THE FACULTY AND STAFF

This process may involve many discussions, meetings and revisions.

REVIEW OF FINISHES, MATERIALS TO BE USED, AND EQUIPMENT ITEMS TO BE INCLUDED IN THE BUILDING CONTRACT

The finishes, materials, and equipment must be reviewed by the Planning Committee of the college or university, the Project Committee, and program specialists. The selections will vary with the amount of money available for building the facility.

OFFICIAL ACCEPTANCE OF PRELIMINARY DRAWINGS AND SPECIFICATIONS

When the schematics and the specifications have been approved by all committees involved, the architect can then proceed with his working drawings and final specifications. Most good architectural firms have men on their staffs who are specialists in specification writing. It is extremely important to have good, clear specifications that will not permit a contractor to take shortcuts. The quality of the specifications will determine the validity of the bidding.

OFFICIAL PREPARATION OF BUILDING BUDGET AND ACCEPTANCE OF TENTATIVE ESTIMATES OF BUILDING COST

On the basis of the preliminary specifications, the building budget must be prepared, the tentative cost estimates approved by the committees, and these documents trans-

mitted to the confirming and appropriating bodies.

THE PREVIEW OF WORKING DRAWINGS AND SPECIFICATIONS

The Campus Planning Committee and the Project Planning Committee normally spend several sessions in previewing the working drawings and specifications of the building.

APPROVAL OF FINAL WORKING DRAWINGS

After the working drawings have been thoroughly previewed by the Campus Planning Committee and the Project Planning Committee, they are given final approval.

OPENING OF BIDS AND THE AWARDING OF CONTRACTS FOR CONSTRUCTION

The contracts for construction are based upon the final working drawings and specifications. The contractors bidding on a construction project will usually fall into five different categories:

- General construction
- Heating and ventilating
- Plumbing and drainage
- Electrical work and lighting fixtures
- Landscaping

ACCEPTANCE OF BUILDING AFTER CAREFUL INSPECTION

Appendix I shows the typical procedure followed in the construction of a building. This can serve as a guide for determining when a building should be accepted.

REVIEW OF THE BUILDING BEFORE THE GUARANTEE PERIOD EXPIRES

The guarantee period for a building is usually one year. An ethical contractor establishes a financial reserve for work that may have to be done during this period.

SELECTED REFERENCES

Crawford, Wayne H., *A Guide for Planning Indoor Facilities for College Physical Education*. New York: Bureau of Publications, Teachers College, Columbia University, 1963.

Engelhardt, N. L.; Engelhardt, N. L., Jr.; and Leggett, Stanton, *School Planning and Building Handbook*. New York: F. W. Dodge Corporation, 1956.

Gabrielsen, M. A., and Miles, C. M., *Sports and Recreation Facilities for School and Community*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1958.

Participants in National Facilities Conference, *Planning Areas and Facilities for Health, Physical Education, and Recreation*. Chicago: The Athletic Institute, and American Association for Health, Physical Education, and Recreation (NEA), 1965.

Scott, Harry A., and Westkaemper, Richard B., *From Program to Facilities in Physical Education*. New York: Harper and Brothers, 1958.

Chapter 4

GENERAL FEATURES OF INDOOR FACILITIES

Well-designed college facilities with functional relationships and aesthetic appeal will help assure optimum use. Careful, cooperative planning by staff, engineers, architects, and competent professional consultants will help to insure that the completed structures are attractive, but more important, that they are functional for those programs which will be offered in them.

Building features that are common to all structures are included in this chapter so that important consideration in planning will be given to the most efficient use of these facilities, while providing for the maximum comfort and safety of participants and spectators. Such essential features as traffic circulation, color and aesthetics, indoor surface materials, sound control and acoustics, electrical systems and service, audiovisual services, mechanical systems, sanitary facilities, and security are covered in detail. Recommendations for these general building features are based on the research, experience, and suggestions of qualified engineers, architects, and professional educators.

TRAFFIC CIRCULATION

Building location is a most important consideration in traffic circulation and control. A careful study of the relationship of the proposed structure to student housing, academic buildings, and the community will provide valuable information relative to placement of primary and secondary entrances and exits.

The foremost purposes of planning for traffic circulation and control include: (1) minimizing congestion in corridors, stairwells, locker rooms, and spectator areas; (2) minimizing the disturbance of students and staff in offices, classrooms, and study rooms; (3) providing for ease of building supervision, and separation of various units where necessary; (4) enhancing efficient and safe movement; and (5) providing for future building expansion.

Ideally the gymnasium structure should be located between the student housing area and the center of the campus. A physical education building that is designed to serve students and staff in instructional, intramural, athletic, and recreational activities should be conveniently located and easily accessible.

Within the building, the control of traffic is related to the location of offices, classrooms, activity areas, service areas, and spectator areas. The anticipated use of the building's facilities should be carefully studied prior to and during the time preliminary layout drawings are prepared.

In the preparation of flow charts, one should consider the required movement of individuals from service areas to activity areas, from classrooms to service areas, and other necessary movement. Those special circulation problems created by intramural, recreation, and spectator programs should also be included in the traffic control study. The placement of service, activity, instructional, and spectator areas should provide for efficient means of supervision of those utilizing the facilities of the building.

SPACE RELATIONSHIPS

The relationship of activity areas, instructional areas, and service areas to the placement and size of corridors, lobbies, stairs, and doors needs careful consideration if the flow of traffic is to move easily and safely. Spectator space, if provided, should be separated from the swimming pool and pool deck areas, the gymnasium floor, and other activity areas. Entrances to the seating area should be direct from the out-of-doors, or from corridors or foyers without requiring travel through locker rooms or across pool decks or gymnasiums. It is also important that traffic to and from the locker room not be across the gymnasium floor. Suggested space relationships in the physical education suite are shown in Figure 2.

The individual components of the dressing and locker room areas should permit entrance to, and exit from, each area without cross traffic in wet and dry areas. The location of toilet rooms in relation to the swimming pool and to outside facilities should be given careful consideration, especially with reference to community or public use.

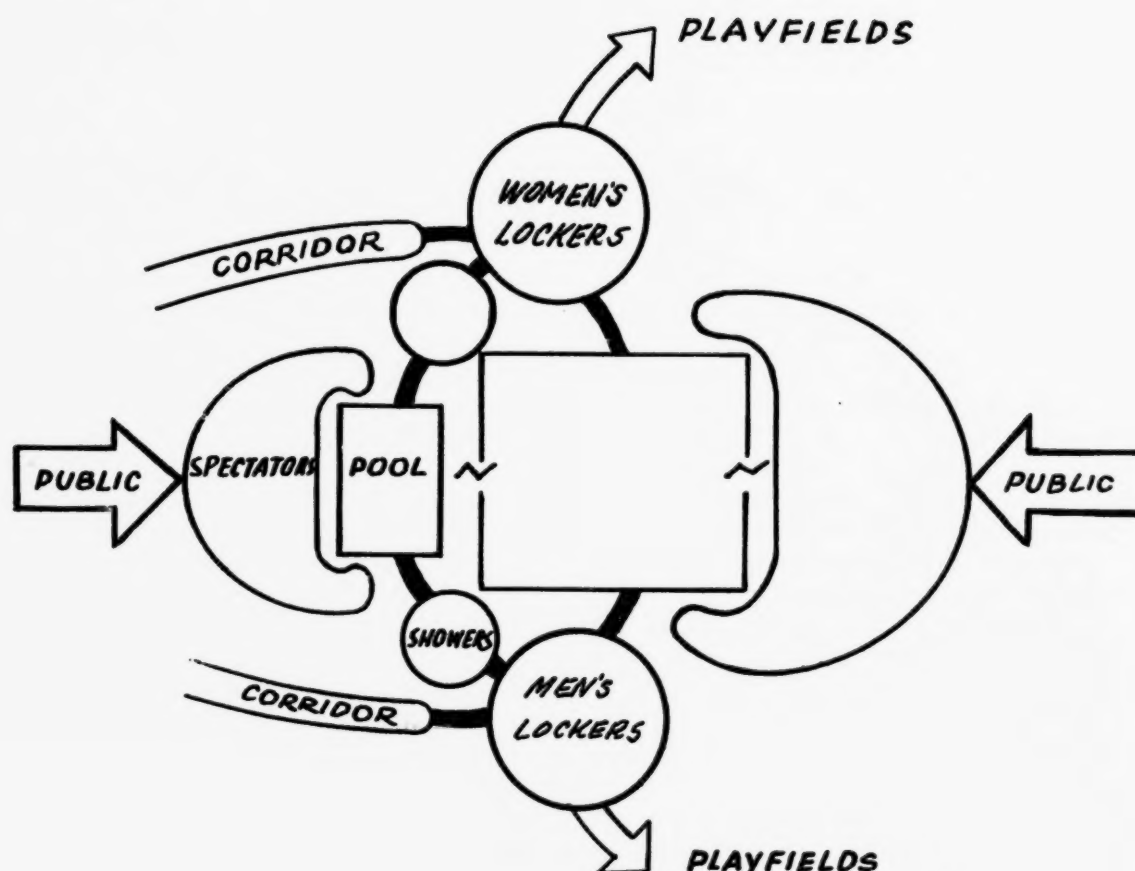
Units within the building which require truck delivery service should be grouped so as to reduce to a minimum the number of delivery points. Delivery of supplies within the building should be planned so there is no traffic or delivery through locker rooms or across gymnasium floors. A loading dock is a most important consideration. In multi-storied structures, elevators should be provided.

CORRIDORS AND FOYERS

In large buildings, the health, physical education, and recreation units should be accessible from at least two corridors or passageways leading from the principal classroom areas of the building to prevent traffic congestion during change of periods. Corridor widths should conform with local and state building codes.

Provision should be made for heavy traffic from the dressing room or the locker suite to playfields. The designated corridor widths should be clear of all obstructions, including the maximum swing of locker and room doors. No corridor should be less than 60 inches in width. All equipment, such as heating units, drinking fountains, fire extinguishers, and telephones, should be recessed. Each end of every corridor should terminate at an exit, or stairway leading directly to a point of exit.

Public-assembly rooms, including gymnasiums, used for large public groups should be designed with entrance foyers. The size of the foyer will depend upon the seating capacity. The planning of this area should include consideration for ticket sales, public telephones, an information desk, and a cloak checkroom. The foyer should be accessible to public toilets for men and women. In many situations, it is advisable to provide cutoff gates so that it will not be necessary to supervise the entire building when specific areas are not in use.



Source: Herrick, John H., Ralph D. McCleary, Wilfred E. Clapp, and Walter F. Bogner. *From School Program to School Plant*. New York: Henry Holt and Company. 1956. p. 325.

Figure 2
Space Relationships in the Physical Education Suite

STAIRWAYS

Buildings of two or more stories should have no fewer than two stairways, located at the extremes. All stairways should be of fire-resistant construction, and all main stairways should lead directly to grade exits. Two-lane stairways are recommended, and they should have a clear width throughout their entire length of a minimum of 44 inches between handrails (see local fire code).

Stairways should be divided into runs of not more than 16 nor less than 3 risers. Risers should not exceed 6-1/2 inches, and treads should be at least 10-1/2 inches measured from riser to riser. The rounded nosings of all treads and landings should have nonslip, flush surfaces. Abrupt overhanging nosing should not be used.

Circular or winding stairways should not be constructed. In some cases, ramps are desirable to compensate for minor differences in levels of floors. These ramps should have nonslip surfaces and should have a rise of not more than 1 to 12; 1 to 15, or 1 to 20 is preferable. Adequate stair aisles must be provided (see state and local codes) for all bleachers of more than three rows, whether the bleachers are movable or fixed.

EXITS AND DOORS

Exits should be located so that at least one exit, or stairway leading to an exit, will be within 100 feet of a doorway of every room designed for occupancy. Every floor of the building should have at least two exits, remote

from one another, and additional exits as prescribed by the National Fire Protection Association formula in the Building Exits Code. Exits should be located for convenience as well as for safety. It is important that the number of exits and their locations be properly related to the seating capacity and the space in the gymnasium or swimming pool.

Folding bleachers are often provided along the sides of the long axis of the gymnasium playing court. When a second level of folding or fixed bleachers is provided on one or both sides of the gymnasium, there should be adequate exits at the four corners of the gymnasium. It should be possible for the spectators to reach the out-of-doors directly from the main level without passing up or down the stairs. With two levels of seating, this is hardly possible, at least on a level site, but stairways or passageways down long hallways should be kept to a minimum.

All doors should open in the direction of exit, with the entire door swinging free of the door opening (side-hinged). Double exterior doors should be provided with a removable center mullion so that each door will operate independently, and at least one such opening should be a minimum of 36 inches wide. Every room should be provided with exits as prescribed by the Building Exits Code, and all outside doors should be equipped with panic hardware.

The doors to rooms where combustible material is kept should be constructed in accordance with Fire Underwriters' specifications. Exterior doors and all doors in damp areas, such as the swimming-pool area, laundry rooms, shower rooms, and dressing-locker suites, should be heavy-duty and moisture-resistant.

If exterior doors cannot be recessed, they should be protected against the weather by projections, overhangs, or soffits. Outside entrances should be provided with mud-and-dirt grates or mats for cleaning the mud and dirt from shoes. One method which has proved satisfactory is the use of a grate-covered recess about six feet long and the width of the door opening, so placed that persons entering the building must walk across it with both feet. Consideration should be given to the size of the openings in the grate to prevent accidents to persons wearing high-heeled shoes.

While minimum widths of corridors, stairways, and exits are determined by local codes, these areas should be considered in the light of maximum use of the building's facilities. Stairways and exits are the most important factors in preventing traffic congestion, and should, in most cases, be wider than the code requirements.

COLOR AND AESTHETICS

Daily contacts with good color design help give individuals an appreciation of aesthetic values and a feeling of pride in their surroundings. Studies have shown that the skillful use of color definitely affects attitudes and work habits.

Color is really no more than a reflected quality of light. The physical function of color is to reflect light in such a way as to provide maximum quality as well as quantity. The psychological effect of color must be considered as well as the physical function. The color scheme of the entire structure should provide a pleasing learning environment. The trend toward the use of light colors is recommended in planning gymnasiums, classrooms, and recreational facilities.

CONSIDERATIONS IN COLOR SELECTION

The geographic location of the facility should influence the type of color utilized. In warm climates, the cool blue-green group of colors is desirable. In northern climates where there are cool areas or cool exposures, the warm red-orange group of colors is preferable. In bright, sunny locations, intense colors are recommended because bright light tends to "wash out" color.

It is quite obvious that the exterior finish of the gymnasium structure should be in harmony with other buildings on the campus. When the design of the building is such that very little light enters any one room, warmer tints of color are recommended. If classrooms, offices, and other areas utilizing natural lighting have a northern exposure, warm colors are recommended, while southern exposures will call for cool colors.

The size and shape of a room can appear to be changed by the skillful use of colors. Small rooms can be made to appear larger by the use of light colors. Saturated colors can be used in large rooms if they do not absorb too much light.

Both the type of lighting fixture and the color temperature of the lamps have an effect on the final color rendition of an area. Colors should be selected under the same light in which the colors are to be seen.

The type of activity should be a factor in determining the exact color of a room or an activity area. In addition to being classified as warm or cool, colors may be stimulating, relaxing, depressing, or neutral. In general, classroom colors should be neutral to slightly stimulating, while gymnasium colors should be slightly stimulating. For example, a bright red in a gymnasium would be too stimulating, whereas a purple would be depressing. Each room in the complex

should reflect an inviting, hospitable, and friendly atmosphere.

LIGHT REFLECTION

Light reflection from surfaces and equipment in a room should be considered in terms of color as well as the type of activity. The following reflection factors, indicated in terms of percentage of light reflection, are recommended by the Illuminating Engineering Society:

Furniture	35% to 50%
Ceilings	70% to 90%
Walls	40% to 70%
Dado or wainscot	40% to 60%
Trim	30% to 60%
Floors or desks	30% to 50%
Chalkboards	5% to 20%
Tackboards	40%
Window walls	80%

These figures provide a guide to light efficiency as well as visual comfort in the various rooms.

In general, walls should be slightly darker than ceilings. Colors in a large area, such as a gymnasium or auditorium, add interest and variety. A reasonable variation in color combinations from room to room, and rooms to corridors, adds to the attractiveness of the entire building.

Natural-finish maple floors in gymnasiums and other similar areas, such as a dance studio, should provide a reflection factor of 30 to 40 percent. Tile or terrazzo floors, or floors made of other synthetic materials may prove satisfactory provided they have the recommended reflection factor and are not of checkerboard design.

Doors to offices, classrooms, and other areas should harmonize with the entire building.

The grays and browns of yesteryear are now obsolete and the trend is toward tints and light wood finishes. Because glossy surfaces may cause excessive glare, it is important that nongloss or matte finishes be used.

FURNISHINGS AND EQUIPMENT

The selection of properly-designed furniture is vitally important. In addition to being of suitable color, furniture should be designed so that it will not mar walls and other furniture.

Where draperies and upholstered materials are used, appropriate color combinations should be planned to achieve color harmony for the area. Lockers, cabinets, and sanitary fixtures may be obtained in colors to harmonize with the prevailing decor.

Gymnasium equipment, such as tumbling mats and gymnastic apparatus, is now available in various colors. Use of attractive color combinations for equipment can help make a gymnasium a pleasant and inviting area.

COLOR CODES

Color codes should be used for purposes of identification and safety. Multipurpose use of gymnasium floors and other areas indicates the need for colored court markings, which can be achieved by permanently-painted lines or by the use of different-colored, sensitized pressure tape.

The recognition of hazards, such as close clearances, edges of openings, moving objects, and barriers, may be achieved more readily if associated with a specific alerting color. For example, red has long been associated with fire extinguishers, fire-alarm boxes, and fire-fighting equipment.

GENERAL FEATURES OF INDOOR FACILITIES

Persons may be alerted to danger or emergency areas by using orange on power controls, rims of pulleys, gears, switch boxes, electrical boxes, or other such potentially-dangerous apparatus. Yellow and orange colors can be used to identify physical hazards, blue can denote an area where caution should be used, white can mark the location of sanitary facilities, and green can be used to identify safety and first-aid equipment.

INDOOR SURFACE MATERIALS

The selection of indoor surface materials becomes a complicated problem because indoor facilities may be subject to hard usage and/or excessive moisture, and they must meet minimum standards in terms of acoustical and light-reflecting properties. Geographic location of the facility and the availability of certain surface materials are factors to be considered in the selection of appropriate surface treatment.

Table 2 indicates suggested indoor surface materials. Other available materials not mentioned in the Table, such as patented resilient synthetic plastics, should be considered. For example, spray or brush glaze is being used for da-does, and, in some instances, is used in locker rooms, shower rooms, and corridors for all wall surfaces.

FLOORS

At least three distinct types of floor surfacing are required in facilities described in this **Guide**. Floors in service areas such as locker rooms, shower rooms, toweling rooms, and toilet rooms require a surface that is impervious to moisture. In general, gymnasiums and other activity areas require a wooden floor, unless specific purposes dictate another type of surface. Classrooms, corridors, offices, and like areas may be grouped together for common surfacing.

In the treatment of floors, it is well to heed the instructions of the manufacturer of the product being used. One satisfactory method for finishing wooden floors is as follows: after initial installation, the floor should be sanded carefully to a smooth finish; it should be cleaned thoroughly without water; next, a penetrating floor seal should be applied and allowed to dry; the floor should then be buffed and painted floor lines added; the sealing process should be repeated, followed by the application of a coat of finish seal.

Special activity areas require different treatments. For example, a dance gymnasium that is used for instruction in modern dance should have a finished treatment so as to allow the dancers to slide or glide across the floor while performing dance movements. In other areas, such as basket-

TABLE 2
SUGGESTED INDOOR SURFACE MATERIALS

ROOMS	FLOORS	LOWER WALLS					UPPER WALLS					CEILINGS											
	Tile, asphalt, rubber, linoleum	Terrazzo, abrasive	Brick	Brick, glazed	Cinder Block	Concrete	Plaster	Tile, ceramic	Wood Panel	Moistureproof	Brick	Brick-glazed	Cinder Block	Plaster	Acoustic	Moisture-resistant	Concrete or Structure Tile	Plaster	Tile, acoustic	Moisture-resistant			
Apparatus Storage Room		1	2			1		2	1	C													
Classrooms	2		1					2		1		2				2	1		C	C	1		
Clubroom	2		1					2		1		2				2	1		C	C	1		
Corrective Room			1			2	1					2		2	2	1	2				1		
Custodial Supply Room		1			2																		
Dance Studio	2		1																C	C	1		
Drying Room (equip.)		1		2	2	1	2	1	1				1		1								
Gymnasium			1			2	1					2		2	2	1	2	*		C	C	1	
Health-Service Unit	1		1					2		1		2				2	1				1		
Laundry Room		2			1	2	1	2	2		1	C	*					*			* *		
Locker Rooms		3		2	1		1	2	2	3	1		*	1		1	2			C	1		
Natatorium					1	2	1	3	2		1		*	2	2	1		*	*	C	C	1	*
Offices	2		1					2		1		1				2	1				1		
Recreation Room	2		1			2		2		1		1		2		1	2	*			C	1	
Shower Rooms		3		2	1		1			2	1		*	2	1	2	2		*			1	*
Special-activity Room	2		1				2			1		1		1		1	1				C	1	
Team Room		3		2	1	2	1	2	2	3	1		*	1		1	2				C	1	
Toilet Rooms		3		2	1		1	2	2	2	1		*	1		1	1					1	
Toweling-Drying Room(bath)		3		2	1		1			2	1		*	2	1	2	2		*			1	*

Note: The numbers in the Table indicate first, second, and third choices. "C" indicates the material as being contrary to good practice. An * indicates desirable quality.

ball courts, the finish should be of a nonslip nature.

The cost of installation is important in the selection of floor surfaces. The cost of floor maintenance and the ease with which floors can be cleaned and repaired are additional considerations in the selection process.

In general, classrooms, corridors, and offices have been satisfactorily surfaced with some type of tile, such as asphalt, vinyl, vinyl asbestos, rubber, or linoleum. Consideration should be given to the use of carpeting in offices, golf-course locker rooms, and other appropriate areas.

WALLS

In addition to segregating specific areas, walls should serve as barriers to sound, light, heat, and moisture. In selecting wall surfacing, consideration should be given to the acoustical properties of the material to be used. In general, moisture-resistant walls with good acoustical properties are recommended. Most modern gymnasiums have smooth surfaces on the lower portion of the walls so they may be used as rebound surfaces. Rough-surfaced walls collect dirt easily and are difficult to clean.

In those areas such as locker rooms, shower rooms, and toilet rooms, where high humidity is often present, it is most important to select surfacing for walls that is highly moisture-resistant and has good acoustical properties. Walls that serve as barriers between toilet rooms, handball courts, squash courts, and other areas where noise is a problem should have a minimum of sound transmission.

CEILINGS

Roof design, type of activity, and local building codes should determine the ceiling construction. Ceilings should be insulated to prevent condensation and should be of a light color to enhance light reflection. Acoustical ceiling materials are necessary in instructional and activity areas.

False ceilings with catwalks above them have been effectively designed to permit maintenance and repair of lighting and ventilating systems.

SOUND CONTROL AND ACOUSTICS

The sonic, or audible, environment is the most difficult phase of the total environment to balance and requires the services of an expert acoustical engineer. Within each room, attention must be given to reverberation time. This is influenced by the absorption and reflection qualities of all surfaces within the room. Hard surfaces reflect sound and produce excessive unwanted reflection and reverberations; thus the space may be "noisy." Soft or absorptive surfaces turn the sound into another form of energy and can produce areas that are too "dead." Therefore, most areas must have some materials with sound-absorbing qualities in order to balance the sonic environment for good hearing conditions.

SOUND INSULATION

Unwanted sound, or noise, may be transmitted into the room by means of ventilating ducts, pipes, and spaces around pipe sleeves. The transmission of sound through ducts can be reduced by the use of baffles or by lining the ducts with sound-absorbent, fire-resistant materials. The ducts may also be connected with canvas to interrupt the transmission through the metal in the ducts. Pipes can be covered with pipe covering, and spaces in the pipe sleeves can be filled.

Sound can also be transmitted through the walls, floors, and ceilings. This can be reduced to a desirable minimum

by the proper structural design and materials. In the conventional wall construction, alternate studs can support the sides of the wall in such a manner that there is no through connection from one wall surface to another. This is sometimes known as double-wall construction. The space inside the walls can be filled with sound-absorbing material to further decrease the sound transmission. Sometimes three or four inches of sand inside the walls at the baseboard will cut down the transmission appreciably. Likewise, sound absorption blankets laid over the partitions in suspended ceiling construction can frequently reduce the sound from one room to another.

Machinery-vibration or impact sounds can be reduced by use of the proper floor covering and/or by installing the machinery on floating or resilient mountings. "Sound locks," such as double walls or doors, are needed between noisy areas and adjoining quiet areas. Improper location of doors and windows can create noise problems.

It is imperative to pay attention to the acoustical treatment of all areas. Gymnasiums, swimming pools, and dressing-locker rooms are frequently neglected.

MATERIALS FOR ACOUSTICAL TREATMENT

Care must be taken in the maintenance of acoustical materials. Oil paint reduces the sound-absorbent qualities of most materials. Surface treatment for different acoustical materials will vary. The most common treatment of acoustical-fiber tile is a light brush coat of water-base paint. It should be noted that most acoustical materials lose their efficiency after several applications of paint.

ELECTRICAL SYSTEMS AND SERVICE

All electrical service, wiring, and connections should be installed in accordance with the requirements of the National Electric Code of the National Board of Fire Underwriters, and of state and local building codes and fire regulations.

The capacity of each individual electrical system should be determined accurately for obvious reasons of safety and economy. Full consideration should be given to present and future program plans when designing the electrical systems. The increasing use of electrically-operated equipment, higher standards of illumination, and special audiovisual equipment should be anticipated.

ILLUMINATION

In addition to the amount of light in any given area, the quality of the light is of equal importance. Providing efficient illumination is most complicated and challenging, and the services of an illuminating engineer are strongly recommended in order to obtain maximum lighting efficiency. Gymnasiums, classrooms, corridors, and other specific areas have distinct and different lighting requirements. Planning for electric illumination requires that each area be considered relative to specific use. In all areas, minimum requirements are recommended in terms of footcandles per task.

MEASUREMENTS OF LIGHT

The footcandle is a measurement of light intensity at a given point. Light intensity, as measured in footcandles, is one vital factor in eye comfort and seeing efficiency, but intensity must be considered in relation to the brightness balance of all light sources and reflective surfaces within the visual field.

GENERAL FEATURES OF INDOOR FACILITIES

The reflection factor is the percentage of light falling on a surface which is reflected by that surface. In order to maintain a brightness balance with a quantity and quality of light for good seeing, all surfaces within a room should be relatively light, with a matte rather than glossy finish.

The footlambert is the product of the illumination in footcandles and the reflection factor of the surface. For example, 40 footcandles striking a surface with a reflection factor of 50 percent would produce a brightness of 20 footlamberts. These brightnesses are necessary when computing brightness differences in order to achieve a balanced visual field.

BRIGHTNESS BALANCE

The brightness balance of illumination is the quality of light achieved by maintaining an acceptable ratio of brightness difference within the total visual field. Brightness balance is important to visual comfort and efficiency, and good lighting involves the proper interrelationships of surface brightnesses and lighting intensities from natural and/or electrical illumination. It is desirable to reduce brightness differences to a reasonable minimum by eliminating the sources of extremely high and low brightness and by increasing the brightness of the dark areas within the total visual environment.

TABLE 3
LEVELS OF ILLUMINATION CURRENTLY RECOMMENDED FOR SPECIFIC INDOOR AREAS¹

Area	Footcandles on Tasks	Area	Footcandles on Tasks
Adapted physical education gymnasium	50	Squash.	70 ²
Auditorium		Tennis	70 ²
Assembly only	15	Volleyball	50
Exhibitions	30-50	Weight-exercise room	50
Social activities.	5-15	Wrestling and personal-defense room	50
Classrooms		Games room	70
Laboratories	100	Ice rink	100 ³
Lecture rooms		Library	
Audience area	70	Study and notes	70
Demonstration area	150	Ordinary reading	50-70
Study halls	70	Lounges	
Corridors and stairways.	20	General	50
Dance studio	5-50 ³	Reading books, magazines, newspapers	50-70
Field houses.	80	Offices	
First-aid rooms		Accounting, auditing, tabulating, bookkeeping, business-machine operation	150
General	50	Regular Office work, active filing, index references, mail sorting.	100
Examining table.	125	Reading and transcribing handwriting in ink or medium pencil on good-quality paper, intermittent filing.	70
Gymnasiums		Reading high-contrast or well-printed material not involving critical or prolonged seeing, conferring and interviewing	50
Exhibitions	50 ²	Parking areas	1
General exercise and recreation	35	Storerooms	
Dances.	5-50 ³	Inactive	10
Locker and shower rooms	30	Active	
Gymnastics	50	Rough bulky.	15
Archery		Medium.	30
Shooting tee	50	Fine	60
Target area	70	Swimming pools	
Badminton	50 ²	General and overhead	50
Basketball.	80 ²	Underwater ⁴	
Deck tennis	50	Toilets and washrooms.	30
Fencing	70 ²		
Handball	70 ²		
Paddle tennis	70 ²		
Rifle range			
Point area	50		
Target area	70		
Rowing practice area	50		

¹ These standards have been developed by a panel of experts on facilities for health, physical education, and recreation after careful consideration of the activities involved. In all instances, the standards in this table are equal to, or exceed, the standards which have been recommended by the Illuminating Engineering Society, American Institute of Architects, and National Council On Schoolhouse Construction.

² Care must be taken to achieve a brightness balance and to eliminate extremes of brightness and glare.

³ Should be equipped with rheostats.

⁴ Must be balanced with overhead lighting and should provide 100 lamp lumens per square foot of pool surface.

Visual discomfort and poor visual discrimination can result from unbalanced brightness conditions. Brightness-difference goals for the total visual environment, where critical seeing tasks are being performed, are as follows:

- The footlambert brightness of any surface viewed from any normal standing or sitting position in the room should not exceed ten times the footlambert brightness of the poorest-lighted task being performed in the room nor be less than one-third of the footlambert brightness of the poorest-lighted task in the room.
- The footlambert brightness of any surface immediately adjacent to the task should not exceed three times the task brightness.
- The brightness difference between adjacent surfaces should be reduced to a minimum.

The brightness goals, as stated above, assume a lighting system that provides from 30 to 70 footcandles on the poorest-lighted task. The extent of the area of the surface producing brightness has a measurable effect upon visual comfort. Small areas of either extremes of brightness are usually less noticeable than are larger areas of the same brightness.

Increasing the quantity of light with little or no consideration for the quality has often resulted in extremely unfavorable visual conditions. Traditionally, we have prescribed the level of illumination desired for various areas in a gymnasium only in terms of footcandles without any consideration for the quality of the reflection. With the shift of emphasis from quantity to quality of light, the illumination levels now recommended (see Table 3) consider quality as well as quantity.

IMPORTANT CONSIDERATIONS

In addition to the quantity and quality of light from the various kinds of lighting systems available, additional factors to consider in the selection of an electrical illumination system are maintenance, repair, replacement, and cleaning.

The ideal lighting fixture has both an indirect and a direct component, throwing surface light on the ceiling to give it about the same brightness as the lighting unit itself. There is less need, however, to provide high-ceiling areas with direct-indirect fixtures. In gymnasiums, swimming pools, and similar activity areas, an even distribution of light is required to permit the individual to see quickly and distinctly in any part of the room. It is advisable to provide supplementary lighting on such areas as those containing goals or targets, and to place dimmers on the lighting in spectator areas. Supplementary light sources should be shielded from the eyes of participants and spectators in order to provide the proper brightness balance.

Transparent, nonbreakable, plastic protective covers will protect lighting units in areas where balls are used. Vapor-proof lighting units are recommended for all damp areas, such as toilets, showers, the dressing-locker suite, and the swimming pool. Locker-room lights should be spaced to light the areas between lockers.

Incandescent, fluorescent, mercury-vapor, and sodium-vapor lighting systems are most commonly used in gymnasium buildings. The incandescent light is instantaneous, burns without sound, and is not affected by the number of times the light is turned on or off. Incandescent lights and fixtures are considerably cheaper in initial cost, are easier to change, and the lamp, within limits, may be varied in size within a given fixture. Incandescent fixtures, however, have excessively high spot brightness and give off a considerable amount of heat, which becomes a problem when high levels of illumination are necessary.

Fluorescent lamps have the advantage of long life and give at least two and one-half times the amount of light that incandescent lamps give for the same amount of current used. They are frequently used in old buildings to raise the illumination level without the installation of new wiring.

Mercury-vapor lighting is most expensive in terms of initial installation. The overall cost of mercury-vapor lighting, however, is cheaper than incandescent lighting. The primary objection to mercury-vapor lighting is the bluish color that results when this system is used. However, when incandescent lighting is used in addition to mercury-vapor, a highly-satisfactory lighting system results.

Night lights which burn continually are recommended for gymnasiums, swimming pools, handball courts, squash courts, and other indoor activity areas. Lobbies, corridors, and some classrooms should also be equipped with night lights. These lights are extremely important for safety and security purposes and should have separate controls.

The recommended method of turning the lights on and off in handball and squash courts is to install switches that are activated by the opening or closing of the door to the court. When the door is opened, the lights will turn off automatically, leaving only the night light to burn continuously. When the door is closed, lights in the court will turn on. This system eliminates the possibility of the lights being left on when the courts are not in use.

Provision for outside lighting should be considered in the entire lighting system. Exit lights must follow the prescribed codes of the local community and the state. Electrically-illuminated exit lights, clearly indicating the direction of exit to the exterior, should be provided: over all exit doors from gymnasiums, combined auditorium-gymnasiums, multipurpose rooms, and other rooms used for assembly purposes; over all exit doors from the building; and at the head and foot of exit stairways. All exit lighting should be on special circuits.

Emergency (white) lighting systems should be provided for exits — including exterior open spaces to which the exits lead — in gymnasiums, multipurpose rooms, and other places of assembly or large-group activity. This lighting should be on a special emergency circuit. All controls should be located so as to be under the supervision of authorized persons, and all other aspects of the installation should meet the specifications prescribed by the Underwriters Laboratories, the Building Exits Code, and state and local fire laws and regulations.

FIRE-ALARM SYSTEM

Electrical fire-alarm systems should be separate and distinct from all program-signal or other signal systems, and should be designed to permit operation from convenient locations in corridors and from areas of unusual fire hazard. All fire-alarm systems should meet the specifications prescribed by the Underwriters Laboratories and by state and local fire laws and regulations.

PROGRAM-SIGNAL SYSTEM

Gymnasium buildings should be wired for a signal system operated by a master clock or push buttons from the main administrative offices. Secondary controls may be placed in other administrative units of the facility.

Program signals should be independent of the fire-alarm system and should not be used as a fire-alarm system (check local and state codes).

GENERAL FEATURES OF INDOOR FACILITIES

Program signals usually include: buzzers or chimes in the classrooms; bells in corridors, pools, gymnasiums, fields, and dressing-locker suites; and large gongs on the outside of the building. In many instances, signals placed strategically in corridors rather than in individual classrooms are adequate. Electric clocks should be included in the program-signal system and should be located in corridors and gymnasiums.

ELECTRICAL SERVICE CONTROLS

The entrance for electrical service should be installed so as to insure the safety of the students and school personnel. When practicable, it should be located at the side or rear of the building, away from heavy-traffic or play areas.

Main service panels with main service switches, meters, and main light and power panels should be located so as to prevent entrance by anyone except those authorized.

Secondary control panels should be placed for the convenient use of individuals who open or close the facilities during hours of darkness or outside of regular hours. Electric lighting and power should be fully available to all athletic, physical education, and recreation facilities during hours when the main offices and classrooms of the building may be closed.

The main distribution panel, all secondary panels, and all circuits should be protected by automatic circuit breakers. A number of spare circuits should be provided in panels for future use. Secondary panels, located in corridors, halls, and similar places, should be of the flush-front type provided with locks.

Wiring for program-signal systems and communications should not be in the regular service conduits. Switches in instructional rooms should be arranged so that the lights adjacent to the interior wall may be controlled independently of the lights adjacent to the exterior wall.

Stairway and corridor lighting should be on separate circuits. Three-way switches should be provided at the foot and head of stairs, near each end of corridors, and near doorways of large classrooms, activity rooms, or gymnasiums. This will permit control of the lights from two or more points. Switches should be located on the open side of entrances to all spaces in the building. Switches should also be provided in projection booths to control the lights in the rooms used for spectator activities. Remote control switches should have pilot lights.

TELEPHONES

In addition to telephones provided in offices and some classrooms, independent telephone service should be provided to the gymnasium, swimming pool, health unit, or other facilities which might be used during hours when the main offices are closed. In those areas where several extensions are necessary, a central exchange system may be used. It is recommended that the local telephone company be consulted in order to provide a satisfactory and economical telephone system.

One or more pay-telephone units should be installed for public use in convenient areas, such as in the gymnasium foyer or near activity areas which serve participants and spectators.

PUBLIC-ADDRESS SYSTEM

Built-in public-address systems are considered a basic

service for indoor and outdoor facilities which accommodate sports events, demonstrations, or similar activities. Special consideration should be given to outdoor areas where large groups gather for outings or intramural and extramural contests. Sound systems should be carefully designed by qualified engineers.

Public-address systems should be designed for flexible use. Microphone inputs and secondary control panels should be located according to the variety of anticipated uses. A built-in system for a large gymnasium or similar area should be able to accommodate such needs as the following: (1) announcements and description of athletic contests and other events, either from the main floor or from a press booth; (2) amplification of vocal and instrumental music or directions for group activity; (3) instructions or announcements in connection with large-group social recreation activities, demonstrations, contests, or meetings; (4) addresses or panel discussions at meetings; (5) directions for building control; and (6) amplification for underwater speakers that can be tied in with the pool public-address system for synchronized swimming and other swimming instruction or contests.

INTERCOMMUNICATION SYSTEM

Means of intercommunication should be provided not only between the main administrative office and the other facilities, but also between individual units of these facilities. Special consideration should be given to the need to communicate with instructors who have groups on outdoor areas. Secondary control panels and microphone-input equipment should be carefully planned so as to permit programs or other communication to originate in places such as the swimming pool or gymnasium.

The central sound system should include provision for both radio and television reception and transmission. Appropriate space and/or special conduits should be provided to accommodate television installation at a later time.

SERVICE FOR OUTDOOR FACILITIES

The master plan should include the lighting of outdoor courts, playfields, stadiums, and other such facilities. Increasing night use of the recreational, instructional, and athletic facilities should be anticipated.

AUDIOVISUAL SERVICE

Many of the units, especially classrooms, health rooms, gymnasiums, and swimming pools, will require electrical service for projectors, tape recorders, record players, portable public-address equipment, and radio and television. The specific needs for such service should be determined before wiring and conduit layouts are designed. It is imperative to install ample conduits and duplex outlets to provide for the increasing use of audiovisual aids. Planners should consult program specialists and professional literature in the fields of health, physical education, and recreation, and, in addition, should consult those qualified to recommend installations dealing with audiovisual equipment.

Light switches should be placed, when possible, near the location where the audiovisual equipment will be used. Power for audiovisual aids, however, should be furnished through outlets independent of the light switches. Two-way switches will adequately accomplish this. In classrooms, it is most desirable that outlets for audiovisual equipment be installed at both the front and rear of the room.

Steel construction and electrical equipment often impede radio and television reception through individual built-in antennas. Therefore, when there is anticipated use of television or radio receivers in the various units of the building, it is desirable to provide connections to a central antenna system or communications center.

In audiovisual rooms, or any room to be used for sound-motion pictures, it is desirable to run an appropriately-sized conduit, with polarized outlets at each end, from one end of the room to the other to carry the sound cable. The desirability of providing a master television antenna from the roof to various points of the installation should be carefully studied. Electrical service for lights and special audiovisual effects should be considered for bulletin boards, display cases, the gymnasium foyer, and other similar locations.

New construction should include provision for the transmission of radio and television programs of several types: (1) public service broadcasts through commercial or educational radio and television outlets, including athletic events, demonstrations, study courses, or other similar instructional, interpretive, or entertainment features; (2) closed-circuit instructional programs transmitted to other units or sections of the same building, or to other buildings on the campus; and (3) closed-circuit instructional programs transmitted to other schools through educational radio and television facilities. Planners should give careful and imaginative consideration to the provision of facilities to accommodate radio and television offerings in their present programs or those for the future.

Larger institutions will find that extensive guidance can usually be obtained from one of the following campus services: instructional resources center, television production center, or audiovisual services. Personnel associated with such centers are increasingly alert to the needs and problems related to developing instructional television systems.

Smaller institutions without such services should consult the latest edition of **Educational Facilities with New Media**. This source contains a thorough discussion of policy-making, facilities design, and technical requirements.

SERVICES FOR APPLIANCES AND OTHER ELECTRICAL EQUIPMENT

There are many needs for electrical wiring and connections which require careful analysis and planning. The following are illustrative:

- Basic construction: motors to operate folding partitions; blowers for heaters and ventilating ducts; exhaust fans in gymnasium ceilings or walls.
- Custodial and maintenance services: receptacles for floor-cleaning equipment and power tools.
- Dressing-locker rooms: wiring for hair and hand driers and electric shavers.
- Lounges, kitchenettes, snack bars, and concessions: outlets for refrigerators, water or soft drink coolers, electric stoves, blenders, mixers, coffee urns, and hot plates.
- Office suites: wiring for individual air-conditioners, business machines, floor fans, and other mechanical and electrical equipment.
- Laundry rooms: wiring for washers, driers, and ironers.
- Pools: provision for underwater vacuum cleaners, pumps, and special lighting.
- Gymnasiums: provision for special lighting effects, spot lights, and rheostats or controls to lower the illumination for certain activities.

- Health suites: receptacles and provision for audiometers, vision-testing equipment, floor fans, and air-conditioning units.

Table 4 summarizes some of the needs for outlets and special wiring and connections.

CLIMATE CONTROL

The engineering design of heating, air-conditioning, and ventilating systems should be based on the technical data and procedures as published by the American Society of Heating and Ventilating Engineers. The selection of the type of heating, air-conditioning, and ventilating systems should be made with special consideration for economy of operation, flexibility of control, quietness of operation, and capacity to provide desirable thermal conditions. The design and location of all climate-control equipment should make ample provision for possible future additions to the facility.

Since the number of occupants in any given area of the building will vary, special consideration should be given to providing variable controls to supply the proper amount of fresh air and total circulation for maximum occupancy in any one area. Specially-designed equipment and controls are necessary to insure that climate control in some major areas can be regulated and operated independently of the rest of the facility.

All three mechanical systems—heating, ventilating, and air-conditioning—are interrelated and should be planned together. It is important to secure the services of a competent mechanical engineer, not only for design, but also for making inspections during construction and for giving operating instructions to the service department.

Some of the problems involved in the installation of heating, ventilating, and air-conditioning systems are as follows:

- Maintaining a minimum noise level.
- Insulating all steam, hot-water, and cold-water pipes and marking them with a color code.
- Exhausting dry air through the locker rooms and damp air from the shower room to the outside.
- Providing a minimum of four changes of air per hour without drafts.
- Installing locking-type thermostats in all areas, with guards wherever they may be subject to damage.
- Placing the thermostats for highest efficiency.
- Zoning the areas for night and recreational use.
- Eliminating drafts on spectators and participants.

The geographical location of the proposed facility will dictate to some extent the type of climate-control equipment selected for installation. Mechanical ventilation is recommended over the open-window method of ventilating any facility. Whereas air-conditioning has been strongly recommended for southern climates, the year-round use of facilities makes air-conditioning a highly-desirable building feature in most areas. Special rooms such as locker rooms, shower rooms, swimming pools, and steam rooms need special consideration for moisture and humidity control.

SANITARY FACILITIES

Well-arranged sanitary facilities are essential to the comfort and convenience of both participants and spectators. Plumbing installations and materials must meet the requirements of the local plumbing code. Safe water-supply and sewage-disposal systems are also required.

TABLE 4
SUGGESTED NEEDS FOR ELECTRICAL SERVICE*

FACILITY	SPECIAL WIRING & CONNECTIONS FOR																
	Communications			Air-Conditioner (220 volts)	Central Intercom	Radio	Television	Display Cases, Bulletin Boards	Exit Lights	Motors, heavy duty, Blowers, Exhaust Fans	Public-address System	Scoreboard	Sieve or Grill, Electric (220 volts)	Telephone	Washer, Dryer, Dishwasher, Disposal	Rheostat, Dimmers	
	Receiving	Sending															
Adapted Physical Education Room		X	X							X							
Administration — Office Suite	D	X	X	D	X				X							X	
Archery Range — Indoor		X															
Audiovisual Room	X	X	X	X	X	X	X										
Auditorium	D	X	X	X	X	X	X			X	X	X					
Bowling Alleys		X	X						X	E	X						
Classrooms		X	X														
Clubrooms	D	X	X	X					X	E							
Corridors										E						D	
Custodial Rooms		X														X	
Dressing-Locker Rooms		X									X						
Equipment Rooms		X	X														
Faculty-Staff Rooms	D	X	X	X												D	
First-aid Room	D	X	X													X	
Foyer		X							X	X						X	
Game Room (Ping-Pong, Billiards)	D	X	X	X					X	E							
Gymnasium & Fieldhouse		X	X	X	X	X	X			X	X	X	X				
Handball Courts																	
Health-Instruction Laboratory	D	X	X	X		X	X	X									
Health-Service Suite	X	X	X	D	X											X	
Kitchen or Kitchenette											X				X		X
Laundry		X									X						X
Library	X	X			X				X		X					X	
Lounge, Social Room, or All-purpose Room	D	X	X	X					X							X	
Multipurpose Room	D	X	X	X	X	X	X			X	X	X					
Outside Areas		X	X		X	X	X					X	X				
Rifle Range — Indoor		X															
Skating Rink (Ice or Roller)	D		X			D	D	X	X	X	X						X
Snack Bars — Refreshment Stands								D	E	X					X		
Stadium		X	X		X	X	X	X	X			X	X			X	
Staff Office & Service Facilities	D	X	X													X	
Storage Rooms (In-season)																	
Storage Rooms (Out-of-season)																	
Swimming Pool		X	X		X	X	X	D	E	X	X	D			X		X
Toilet and Shower Room											X						

Legend:

X—This kind of service or equipment is either necessary or often found in the facility.

D—Desirable or sometimes found in the facility.

E—Exit lights needed if opening to exterior or if spectators or large groups assemble in the facility.

■ — Duplex outlets should be installed in all rooms in anticipation of present and future needs.

Construction materials selected for sanitary facilities should be stain-resistant and easily cleaned. Structural tile with a glazed face, ceramic facing tile, terrazzo, and other impervious materials are recommended for use in this type of facility.

TOILET ROOMS

Toilet rooms should be located as follows: (1) near the points of entrance to gymnasiums, the field house, and other similar areas; (2) convenient to outdoor facilities; (3) in each locker room and dressing room; and (4) near offices of administrators and faculty members.

Toilet rooms will vary in number, size, and location, depending upon the scope of the program, the type of facility, the seating capacity, the general location of the facility within the plant, and whether the facility will be used by both participants and spectators. Entrances to toilets and other areas within the general dressing rooms should be protected by sight barriers. If windows are included, they should be above eye level and should be opaque. Clearly-marked signs indicating the location of the toilet rooms should be included in all facilities.

MIRRORS

Mirrors should be placed in all toilet areas, preferably on the walls near the exits. To avoid crowding around the lavatories, no mirrors should be placed over them. In the women's locker rooms and toilet rooms, full-length mirrors placed close to the exits are recommended.

Returns, rather than shelves, should be constructed. They should be approximately 10 inches in width and should be located at wainscot height beneath all except full-length mirrors.

DRINKING FOUNTAINS

Drinking fountains should be provided at or near the entrances to activity areas, in locker-and-dressing rooms, and at strategic points to serve outdoor facilities. It is recommended that fountains not be located in the gymnasium itself.

If fountains are located in the corridors, they should be recessed to the full depth which construction will permit. Face-mounted or projecting fountains should not be installed in activity areas.

Each fountain should be equipped with one sanitary-type bubbler head. The orifice should be above the rim of the bowl and should be of a type to prevent the mouth from coming in contact with the nozzle, and to prevent the water from falling back into the nozzle. Self-contained water-cooled units have proved to be very satisfactory.

Outdoor fountains should be secured to a building or permanent structure and should be of the frostproof type, with the same sanitary and safety features. The height from the top of the nozzle to the ground should not be less than three feet nor more than three and one-half feet.

Supply lines to drinking fountains should be kept some distance from hot pipes and warm spaces. Each fixture should be equipped with an automatic pressure-control device.

LAVATORIES

Lavatories should be provided in each toilet room and

each locker-and-dressing room. The type selected should be of vitreous china, with backs and aprons. Floor-supported types are not desirable because of cleaning problems. Recent developments and experiences indicate that wall-mounted lavatories are preferred because of ease of maintenance.

Sinks with shallow aprons and with the drain and the deep part of the basin to the rear are more desirable. A mechanical stopper is recommended. Individual liquid soap dispensers should be installed near each lavatory. Returns should also be installed above lavatories.

WATER CLOSETS

Water closets should be of the extended-lip or elongated-bowl type, made of vitreous china, and equipped with impervious open-front seats. Individual flush valves, located about 36 inches above the floor, are recommended. Fixtures should be 12 to 15 inches in height.

Wall-mounted water closets are recommended. They should have a rapidly-receding front design. The plumbing to water closets should be easily accessible from the rear to facilitate service and maintenance.

URINALS

Urinals constructed of vitreous china should be provided in each toilet room and near the entrance to each shower room, and should be equipped with a hand-operated, foot-operated, or automatic flushing device.

Wall-mounted urinals are recommended. Floor-mounted urinals and trough urinals are extremely undesirable. The advice of an informed professional physical education woman should be obtained in selecting urinals for women.

HOSE BIBBS AND FLOOR DRAINS

Each public toilet, locker-room toilet, locker-and-dressing room, swimming pool area, field house, custodians' closet, and other similar area should be provided with hose bibbs. It is best that these bibbs be key-operated, with the exception of those for the service custodian. They should be recessed in walls or located under lavatories.

Frostproof hose bibbs should be provided for the cleaning and maintenance of track equipment, hard-surface areas, and other outdoor facilities. Where provided, hose bibbs should be recessed or otherwise protected. Where hose bibbs are placed above the ground adjacent to the buildings, they should be high enough for filling buckets.

Floor drains should be provided in each of the following areas: toilet rooms, shower rooms, toweling areas, locker rooms, laundry rooms, team rooms, drying rooms, training rooms, custodians' closets, and swimming pools. If there are corridors leading to swimming pools, these corridors should be equipped with floor drains.

HOT-WATER SUPPLY

Hot water to shower heads and lavatories should not exceed a temperature of 120°F. Faucets should be of a type that delivers both hot and cold water. A mixer valve which equalizes the pressure should furnish hot water to faucets and shower heads.

Hot water should be supplied to custodians' closets. An innovation in custodians' closets is to have the floor serve as a sink by the installation of ceramic tile on walls, with a six-inch lip on the floor. This will provide a sink and a drain, and will facilitate the filling and emptying of buckets.

CUSTODIAL FACILITIES

Providing well-planned quarters for the custodial staff encourages systematic management, efficient and economical use of supplies and equipment, and, most important, a high standard of workmanship. The standards of housekeeping and maintenance must be high to promote the observance of good health and safety habits. Custodians should assist in the planning of facilities for their own use. Custodians' closets should be planned in relation to the maintenance equipment and materials to be used, and to the areas to be served.

The custodian may require a ventilated supply storage space adjacent to toilets, dressing rooms, and shower rooms of the gymnasiums. This space may provide storage for such supplies as paper towels, toilet paper, light bulbs, soap, detergents, wax, and polish. It should also be large enough to accommodate electrical cleaning machines. A hook strip should be provided for hanging mops and brooms.

Large portable cleaners are less expensive and more flexible than a central vacuum system. In buildings of two or more stories without elevators, duplicate equipment for each floor is recommended.

If it is necessary to plan for the disposition of waste material by the use of incinerators, special precaution should be taken to control smoke and to eliminate fire hazards. If waste materials are to be transported, which is preferable in most instances, containers should be located so as not to interfere with the normal traffic of the building.

SECURITY

The physical education complex presents a unique problem relative to the development of features that lead to security. The facilities and the program attract large numbers of individuals who move at all times during the day, throughout the week, and through many kinds of areas and in many different directions.

There is scarcely a real traffic flow and hardly a pattern, except for individuals. The building presents an intermeshing of movement. This is the type of building which people are entering through many outside doors and dispersing to offices, classrooms, or dressing rooms. Other individuals are going to spectator galleries.

It is reasonable to believe that all students and visitors who come to the building have a distinct purpose for entering, and, as such, should be welcome. There should be some plan for pedestrian control and for the handling of visitors who wish to observe activities within the building.

Security within a building is accomplished in the following two ways: (1) constructing the facilities according to a plan which makes for maximum security; and (2) adopting an administrative plan for the direction and control of all persons using the building.

The physical layout will facilitate the accomplishment of security measures but will not guarantee them. A good administrative plan will help insure the accomplishment of security. However, the implementation of a good administrative plan cannot completely accomplish effective security if the physical layout does not lend itself well toward the attainment of such security.

SECURITY FEATURES OF CONSTRUCTION

Entrance doors constitute the first barriers against illegal intrusion. Open and descending stairways, walled entries, and deep-set entrances should be avoided. The points of entrance to buildings should be well lighted from dusk until

dawn. The corners of the buildings should have floodlights which light the face of the structure. So-called "vandal lights" should be selected and protected to make them vandalproof.

Corridors which are continuous and straight, providing unbroken vision, add qualities of safety and security to the building, its contents, and its users. Corridors are often best lined up with entrance doors, making it possible to have a commanding vision of the doorway from the corridor, and of the corridor from the entrance door. There should be an attempt to avoid angularities in corridors, and to eliminate small effects, niches, or cubbyholes. If such extra areas occur in planning, they should be included in adjacent rooms or in corridors where a locking door will close off and control the space.

The use of night lighting within the building and at its entrances will give protection against vandalism and other forms of undesirable conduct. Night lighting will necessitate separate wiring and switches in order to maintain a desirable amount of illumination. Switches for such lighting should be key-controlled to prevent their use by unauthorized individuals. A building chart for day and night "on" and "off" lights should be developed. There should be additional directions for "on" and "off" at every switch, and such directions should be changed according to need. A key-station system for night-watch checking is desirable.

SECURITY OF THE BUILDING

To secure the building and its component rooms against illegal entry is the first and most logical consideration in terms of building protection. Good door framing, substantial doors, and heavy-duty hardware and locks hold up against wear and abuse. In their long life and securing qualities, they constitute a reasonable investment. In reducing replacement costs for materials and labor, the installation of good hardware is an economy in the long run. In reducing loss by breakage and theft, the additional security factor of quality hardware should never be overlooked at any cost.

A lock-and-key system, developed with the help of experts in the field of building administration, will usually result in a plan which considers some of the following features: (1) a building master plan, including a lock-and-key system; (2) lock-tumbler adjustments so that an area may have its own control and authorization; (3) area division (vertical division) by responsibility or usage for key assignment; or "level" division (horizontal division) for key assignment; or a combination of both vertical and horizontal divisions; (4) a policy of not lending keys is recommended; the person to whom the key is assigned signs a pledge for no lending; the keys for the facilities should be identified by a distinguishing mark, and a policy should be established with key duplicators in the area that they will refuse to duplicate keys carrying such identifying marks; (5) an annunciator system in which outside or other doors of importance, such as swimming pool doors, may be connected to an electrically-controlled system. Any door can be connected in or out of the annunciator by a lock-controlled switch at the door, or a switch at the annunciator. Thus, a door tampered with or illegally opened after the annunciator is set for the "on" position will direct a warning signal. The annunciator may be developed to work by a light on a control box, the sound at a control box, an alarm sound of general broadcast in the building, or an alarm system with signals directed to the campus security office. The nature of the annunciator response should be determined by whether it is wished to quietly apprehend unauthorized persons, or if it is desired to deter them or frighten them away.

SECURITY OF PARTICIPANTS

Security and safety suggestions related to the use of specific facilities ordinarily found in a gymnasium structure are given below:

- All swimming pool doors are to be locked unless unlocked by a person authorized to do so. When a door is unlocked for a purpose, the individual unlocking the door is responsible for the accomplishment of that purpose in the pool area. Outdoor, and some indoor, pools may be desirably connected with a sonar detection system or a sound amplification system which will announce illegal use or entry. The signal can go to one or several strategic control points. Swimming pools should normally be keyed differently than other areas in the structure.
- In a gymnastics gymnasium, or where there are related gymnastic activities, the room, or certain pieces of equipment, such as trampolines, must be locked except when an instructor is directly in charge. Providing storage areas sufficiently large to store all equipment for this activity is recommended. If possible, a separate room which is secure from students and faculty is most desirable.
- In viewing balconies, stairs should have handrails and lights at the sides, or luminous reflectorizing material on the edges. Bleacher seats should have aisles and exits to allow rapid clearing other than to the playing floor.
- Activity-room floors should be free of objects or floor plates which set up above the floor level.
- Shower-room and dressing-room floors should be kept free of objects and obstructions which may cause foot injury.
- Shower rooms should be equipped with towel bars to aid in safety of those individuals using the facility. Hot water available through shower heads should have a maximum temperature of 120°F.
- Areas for vigorous activity, where combatives or competitive sports are engaged in, should have floor and/or wall covering to protect the participants. No specifications or classifications are given here, but every consideration is urged and every precaution should be taken.

- Doors to steam rooms and dry-heat rooms must be locked from the outside when the room is unsupervised. The door should have an instruction plate by the door lock, bearing directions to those who have a key to unlock the door. Steam-room controls should be set not to exceed a maximum room temperature of 130°F. This control should be tamperproof. The steam room should have a bar latch of the panic type (noncorrosive hardware) to make exit readily possible under any conditions, even if the door should be locked from the outside.

Accepted standard building safety practices should be employed. State and local requirements and regulations for stair widths, ingress and egress openings, fire escapes, fire alarms, fire extinguishers, and exit lights must be met. Open and straight hallways leading straight to outside doors should be clearly marked and used for exits. Panic hardware should be installed on all doors which lead from areas of assembly to corridors or to the outside.

The safety and security of participants must be given great consideration in planning for the location of entrances to dressing rooms and to toilet rooms. Dressing-room entrances should be away from the main traffic and in the area where only participants go to change clothes. Toilet rooms should be away from direct view of the lobby, and yet be in service corridors rather than in isolated parts of the building.

Stairs should be well lighted. In some cases, the edges of stairs should be marked. Objects in the building which may need to be identified for safety or position may need to be color coded or marked in some manner. In basement passageways and around motors and equipment, it is important to mark corners, low pipes or beams, and safety-zone areas. On main floors, it is desirable to mark fire alarms and extinguishers, some traffic lanes, and first-aid boxes, and to indicate service and toilet areas with their appropriate service designations by door labeling or signs at door-top height. Designation of objects can be accomplished by painting the objects or zones according to a color code.

The reader is referred to Appendix G for building adaptations to accommodate the aging and the disabled.

SELECTED REFERENCES

- Brewster, Sam F., *Programing, Planning, and Construction of College and University Buildings*. Provo, Utah: Brigham Young University Press, 1963.
- Crawford, Wayne H., *A Guide for Planning Indoor Facilities for College Physical Education*. New York: Bureau of Publications, Teachers College, Columbia University, 1963.
- Green, Alan, C., ed., *Educational Facilities with New Media*. Washington, D.C.: National Education Association, 1966.
- Kaufman, John E., ed., *I. E. S. Lighting Handbook*. New York: Illuminating Engineering Society, 345 East 47th Street, 4th ed., 1966.
- Scott, Harry A., and Westkaemper, Richard B., *From Program to Facilities in Physical Education*. New York: Harper and Brothers, 1958.
- Seagers, Paul W., *Light, Vision and Hearing*. New York: Better Light Better Sight Bureau, 1963.
- Seagers, Paul W., *Visual Environment for School Rooms*. Bloomington, Ind.: Division of Research and Field Services, Indiana University.
- Seagers, Paul W., and Hart, G. Harold, A.S.I.D., *Functional Color for the Classroom*. Chicago: Brunswick-Balke-Collender Company, 623 South Wabash Avenue, 1958.

Chapter 5

GENERAL FEATURES OF OUTDOOR FACILITIES

When planning outdoor facilities, a number of general features must be considered. Among these are fences and walls, grading and drainage, lighting, orientation, landscaping, surfacing, and parking. All must be carefully and thoughtfully integrated into the overall planning if the completed plant is to be aesthetically pleasing as well as functional.

This chapter attempts to convey to the reader the importance of the many different facets involved in the planning of outdoor facilities. It is not an attempt to provide specific technical information. The services of qualified professional consultants and engineers should be obtained for this purpose.

FENCES AND WALLS

Fences and walls around facility units are frequently required for purposes of isolation, enclosure, separation, traffic control (pedestrian and vehicular), and the protection of participants, the general public, spectators, and property. Walls or plant-life barriers may be used for sound and wind control, and for screening out undesirable features.

FENCING

Some characteristics of good fencing are stability, durability, economy of maintenance, attractiveness, and effectiveness. Among the many types of suitable fencing available, woven-wire fencing of the chain-link type (minimum thickness—11-gauge), using H-type line posts or circular posts, has been found to meet requirements satisfactorily.

All chain-link fencing should be installed so that the smooth edges are at the top and the sharp edges are at the bottom. In some cases, however, it may be desirable to have smooth edges at both top and bottom. A hard-surface strip about 12 inches wide may be placed under the fence to facilitate maintenance (grass cutting, etc.).

Fences may be painted for beautification purposes. The brush method of painting produces acceptable results but is exceedingly expensive. Spraying may be objectionable because of the drifting action of the fine spray. The roller method seems to be the most efficient and economical.

Attractive plastic-covered fences are available in several colors.

WALLS

Walls can be constructed of many kinds of masonry material. While they are expensive, they may be necessary for sound or visual control, or as a method of solving the problem of change of elevation from one area to another. Walls are frequently used for such program activities as tennis and handball.

GRADING AND DRAINAGE

The development of any site should include the preparation of an overall grading-and-drainage plan prepared by a competent professional. This will assure proper attention

to these very important considerations.

SURFACE DRAINAGE

Surface drainage on unpaved areas should be controlled by slope grading to natural or artificial surface-water collectors, to carefully located surface inlets, or to catch basins connected to a storm-water drainage system. In order to facilitate surface drainage of activity areas, a good general rule is to establish a minimum slope of one percent in non-competitive sports areas. As a rule, the surface slope of paved areas should be a minimum of one percent except when used for competition. Exceptions to the above may be necessary. When certain soil and area-use conditions exist, the degree of slope may be lessened.

SUBSURFACE DRAINAGE

Subsurface drainage can be effected by using either porous subsoil foundations or perforated drain tile. In regions of severe frost, where surfaces are to be paved, natural or tile subsurface drainage is essential. All drainage tile should be installed after rough grading is completed.

LIGHTING

The extensive use of outdoor lighting should be considered on the basis of meeting the criterion of maximum use of facilities. The availability of facilities in the evening hours, after the heat of the day, can greatly increase interest and participation.

The lighting of outdoor areas involves many problems not encountered in other types of lighting. A good lighting installation can only result from careful blending of the proper quantity of light, which is relatively easy to provide, with a good quality of light.

The importance of competent technical consultation in dealing with outdoor lighting cannot be stressed too strongly. This is of paramount significance if a satisfactory facility is to be secured. Private consultant firms, local utility companies, and manufacturers of lighting equipment are available in all sections of the country, and their help can often prevent costly mistakes.

LIGHTING OF SPORTS FACILITIES

The most complete and reliable source of general and specific information on the subject of sports-facility lighting is the Illuminating Engineering Society's publication entitled "Current Recommended Practice for Sports Lighting." This publication covers all aspects of sports lighting in considerable detail.

Table 5 lists illumination levels for outdoor facilities which have been recommended by a panel of health, physical education, and recreation facilities experts. In all cases, these recommendations are equal to, or exceed, the illumination levels recommended by the Illuminating Engineering Society.

TABLE 5

LEVELS OF ILLUMINATION CURRENTLY RECOMMENDED FOR OUTDOOR SPORTS AREAS*

Sports Area	Footcandles on Task
Archery	15
Badminton	30
Baseball	100-150
Basketball	70
Corkball	30
Field Handball	30
Field Hockey	30
Football	100-150
Golf Driving Range	30
Handball	60
Horseshoes	30
Ice Hockey	70
Lacrosse	50
Rifle and Pistol Range	100
Rugby	100
Skating	30
Soccer	100
Softball	100
Speedball	100
Tennis	70
Volleyball	70
Swimming Pool	30

*Because of the nature of outdoor lighting and the types of fixtures available at this time, it is difficult, if not impossible, to reach the lighting levels desired for most outdoor activities. However, it is expected that further improvement in outdoor fixtures will provide the desired higher-level intensities with a minimum of direct glare.

GENERAL AREA LIGHTING

Where specific sports-facility lighting is not required, modified or general lighting can be provided. Generally mounted on poles or structures on the perimeter of the area, this type provides sufficient lighting for movement throughout the area and is usually arranged so as to cover as much territory as possible with the greatest economy. Time clocks can be incorporated into the system so that the lights turn off at a specified time.

For both sports-facility and general area lighting, underground service through conduits is recommended.

HOUSING FOR ELECTRICAL CONTROLS

A vital part of any outdoor-lighting system is the protective and control equipment necessary to make it function. The very nature of this equipment represents a real hazard to anyone not completely familiar with its operation and the characteristics of electricity.

The development of new light sources has resulted in more frequent use of high voltage for larger outdoor-lighting systems. Distribution systems of 240 and 480 volts are no longer uncommon, and, in some instances, a primary distribution system utilizing 2,400 or 4,160 volts to strategically-placed distribution transformers can be justified.

Wherever such equipment is located, the controls must be adequately housed and padlocked. Where buildings or bleacher complexes are adjacent to the lighted area, consideration should be given to locating the controls inside a control room where they can be properly protected from access by unauthorized persons.

ORIENTATION OF AREAS

Courts and fields should be oriented to give protection to both players and spectators, with major consideration to those players who need it most. It may not be possible to get the best orientation of a particular court or field because such factors as topography, shape of the area, and location of other facilities may dictate some variations.

Outdoor courts and fields should be oriented so that the late-afternoon or early-morning sun's rays will intersect the general path of the flight of the ball at an angle of approximately 90 degrees. Otherwise, players on the eastern end of the fields or courts will have to face the sun during afternoon play. In rectangular fields and courts, the general pattern of the ball's flight is parallel to the long axis of such areas. Therefore, the long axis should generally be at right angles to the late-afternoon sun's rays. Locate the sun-set position at midseason of the sport and orient the field or court accordingly.

On baseball, softball, and similar fields, the general pattern of the ball's flight does not parallel any axis. Instead, it covers an arc of more than 90 degrees. Since the field cannot be oriented to give equal protection to all players and spectators, a choice must be made. Because the batter, pitcher, and catcher are in the most hazardous positions, they should receive first consideration. Thus, a line through these positions should be the axis for orienting the field. The field may be properly oriented by ensuring that the imaginary line from home plate to second base is at right angles to the rays of the late-afternoon sun.

PARKING

The need to provide off-street parking for automobiles is a major consideration in the design of facilities. A careful study should be made to determine the space requirements.

Careful attention to the design of facilities is necessary so as not to locate the parking area where it conflicts with pedestrian use of the building and outdoor facilities. Parking lots should be placed so as to best serve the spectators, custodial staff, faculty, and the ever-increasing number of student cars.

Each parking space should be marked. It is often more desirable to construct parking areas in several locations, near the facilities which have the highest concentration of users. This will also make it easier to blend the parking areas into the landscape. Where possible, parking areas should be located near the perimeter and should be designed so as not to interfere with normal pedestrian use of the area. In the case of large parking areas, it is necessary to make a study of the traffic pattern in the surrounding area in order to facilitate the movement of traffic to and from the parking area.

The off-street parking areas should be hard-surfaced, and, when wisely planned, may be used for sports, free-play activities, driver education, marching-band maneuvers, and other activities. Either post sleeves, flush with the surface, or portable standards will make it relatively easy to conduct a variety of net games on these areas.

An individual parking space is figured at 10' x 20'. To this must be added circulation roads, entrances, exits, walks, and planting islands.

PLANTING AREAS

Plans and specifications for landscape plantings should be prepared at the same time as those for the original site development. This will ensure that the plantings will be in keeping with the total development.

Planting areas should serve both functional and aesthetic purposes. They should be arranged to form a pleasing pattern, with open areas, walks, and drives. Plantings are not only used for enclosures for certain spaces, but also serve as excellent buffers to cut down on noise. Good planting design in the development of buffer strips, enclosures, and screening should provide a pleasant pattern of overall landscape treatment. The services of a landscape architect should be obtained.

SURFACING

There is no one surface which will satisfactorily meet the needs of all outdoor activities. Each activity has its own surface requirements, which will dictate what type, or types, of material can be used.

In the selection of surfacing material for any outdoor area, certain qualities should be sought. These include:

- Multiplicity of use
- Durability
- Dustless and stainless
- Reasonable initial cost
- Ease of maintenance
- Low maintenance cost
- Pleasing appearance
- Nonabrasiveness
- Resiliency
- Year-round usage

Obtaining the proper surface for outdoor areas continues to be a perplexing problem. Over the years, however, there have been significant developments in surfacing. The various types of surfacing materials are shown in Table 6. In Figure 3, turf, soil, aggregate, concrete, and synthetic sur-

facing materials are combined to provide an attractive and functional facility.

TABLE 6
TYPES OF SURFACING MATERIALS

Group	Type
Earth	Loams; sand; sand-clay; clay-gravel; fuller's earth; stabilized earth; soil-cement
Turf	Bluegrass mixtures; bent; fescue; Bermuda
Aggregates	Gravel; graded stone; graded slag; shell; cinders
Bituminous (asphalt-tar)	Penetration-macadam; bituminous or asphaltic concrete (cold and hot-laid); sheet asphalt; natural asphalt; sawdust asphalt; vermiculite asphalt; rubber asphalt; cork asphalt; other patented asphalt mixes
Synthetics	Rubber; synthetic resins; rubber asphalt; chlorinated butyl-rubber; mineral fiber; finely-ground aggregate and asphalt; plastics; vinyls
Concrete	Monolithic; terrazzo; precast
Masonry	Flagstone (sandstone, limestone, granite, etc.); brick; etc.
Miscellaneous	Tanbark; sawdust; shavings; cottonseed hulls

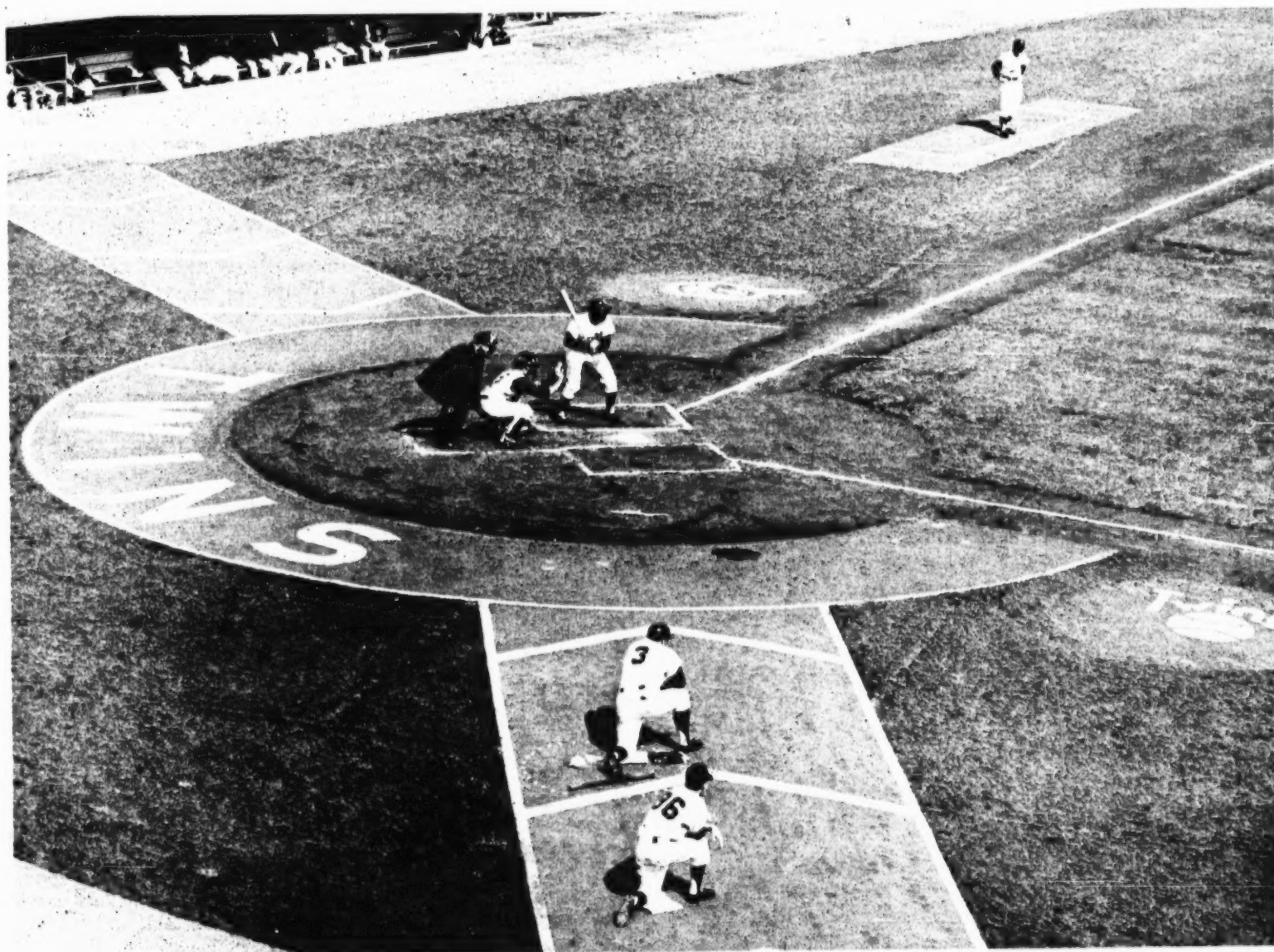


Figure 3
Illustration of Several Types of Surfacing

TURF

The advantages of using grass as a surface are its attractiveness, resiliency, and nonabrasiveness, and the fact that it is relatively dust-free. Such a surface lends itself very well to activities that require relatively large areas, as most field games do.

Turf is difficult to maintain in areas where there is intensive usage. In some parts of the country where watering is essential, maintenance costs are high. Turf surfaces are not practical for most activities when the ground is frozen or wet, and, in addition, must be given time and care to restore themselves after heavy use.

Since climatic conditions and uses should determine the species of grass selected for a particular locality, careful consideration should be given to the several varieties available.

SOILS

Among the difficulties encountered in the use of earth as a surfacing material are dust and the tendency to become rutted, which, in turn, create drainage problems and relatively high maintenance costs. These difficulties can be partially overcome by mixing the earth with clay or sand. When this is done, the resulting surface is often less resilient and somewhat abrasive.

Natural soils can also be stabilized by the addition of asphalt, resin, or cement, which are the most commonly used stabilizers. The use of stabilized soils is a possibility in many areas where turf is impractical or cannot be grown.

MASONRY

Natural-stone slabs, or blocks, and manufactured brick can be used for such installations as walks and terraces, where interesting and attractive patterns, colors, and textures are desired.

CONCRETE

Concrete surfaces provide year-round and multiple usage. The costs of maintenance are very low and the surface is extremely durable.

BITUMINOUS

The common bituminous surface has many of the advantages which are sought in any surfacing material. It provides a durable surface which can be used on a year-round schedule. The maintenance of a bituminous surface is easy and inexpensive. Such a surface can also be used for many different activities. When properly installed, the surface is dust-free and drains quickly. Asphalt surfaces can

be marked easily and with a relatively high degree of permanence. Asphalt also provides a neat-appearing, no-glare surface that will blend well with the landscape.

The disadvantages of bituminous surfaces are their relatively high installation costs and lack of resiliency as compared to some other types of surfaces. However, the high installation cost will be offset by low maintenance costs.

Bituminous surfaces will vary as to firmness, finish, resiliency, and durability in direct relation to the kinds and proportions of aggregates and other materials used in their mixture.

Asphalt can be combined with a variety of other materials to provide a reasonably resilient or extremely hard surface. The use of such materials as cork, sponge, or rubber in combination with asphalt will yield a fairly resilient surface. Aggregates such as slag or granite will produce an extremely hard surface when combined with asphalt.

SYNTHETICS

Some synthetic materials appear to combine many of the qualities sought for outdoor surfaces. New products are constantly being tested and marketed, some of which have proved to be highly satisfactory for tennis courts, running tracks, and other installations. Very little maintenance of synthetic materials is required, thus maintenance costs are low. Most synthetics have a very pleasing appearance and are available in different colors. They are nonabrasive and suitable for year-round use.

There are a number of commercially-manufactured synthetic compounds, such as chlorinated butyl-rubber, rubber asphalt, synthetic resins, mineral fiber, finely ground aggregate and asphalt, plastics, and vinyls. They come in a variety of textures, colors, weights, and thicknesses. Most synthetic surfaces have a high degree of resiliency, which makes them desirable for many types of athletic activities.

WALKWAYS

All-weather walks should be confined to a minimum in open play areas and should be provided only where the foot traffic is heavy enough to warrant their need. They should vary in width in accordance with the anticipated traffic density and should not cross through game courts. It may be necessary to use signs, pavement lines, and fixed or planted barriers to accomplish the desired circulation movement. The degree of slope, and subsurface drainage should be given careful study.

In developments where it is impractical to service features and facilities with drives, or from adjacent street pavements, selected walks should be of heavier construction and of sufficient width to accommodate service-truck loads.

SELECTED REFERENCES

Gabrielsen, M. A., and Miles, C. M., *Sports and Recreation Facilities for School and Community*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1958.

Herrick, J. H.; McLeary, R. D.; Clapp, W. F.; and Bogner, W. F., *From School Program to School Plant*. New York: Henry Holt and Company, 1956.

University of the State of New York, *Planning the Outdoor Physical Education Facilities*. Albany: Division of School Buildings and Grounds, University of the State of New York, 1954.

Chapter 6

INDOOR ACTIVITY AREAS

Activity areas included in this chapter are those specific sports and dance areas commonly found in gymnasium buildings. Included also are basic guide lines for planning and designing these areas.

GUIDE LINES FOR EFFECTIVE PLANNING¹

Planning can be effective only if the major purposes and uses of each specific area are clearly defined and interpreted. The factors to be considered are: (1) the types of activities to be conducted in a single area; (2) the number, ages, and skill levels of the participants using each area; and (3) the length of seasons or periods of use.

Because programs are subject to change, and because they vary in different localities, standardized, or stock, plans for facilities are rarely acceptable. Each facility should be planned to accommodate the program to be offered by the particular college or university.

Specific activity areas should be designed and located after careful consideration of: (1) the surrounding landscape; (2) other existing facilities in the immediate area; and (3) available construction materials near the geographic area. For suggestions on the relative location of specific facilities, see Figures 12 and 13.

Functionability should be the primary consideration in facility planning. Attractiveness is also an important consideration in that facilities should always contribute to the appearance of the particular surroundings.

Facilities should be planned for multiple use whenever such use can be justified. It is apparent that most facilities depreciate either with or without use, and more hours of worthy use per day results in the facility serving its purposes more effectively. Following are examples of some acceptable combinations for multiple use:

- Basketball courts designed for basketball, badminton, volleyball, tennis, dancing, and adapted activities
- Recreation gymnasium designed for all types of gymnasium games plus social recreation activities
- Handball courts designed for handball, squash, paddleball, and tennis drills
- Therapeutic exercise room designed for additional use as a general conditioning and weight-training area
- Swimming area designed for competitive swimming and diving, plus instruction, recreational swimming, and water polo.

Facilities should be planned so that insofar as possible all activity areas are conveniently available to both men and women. It is usually unwise to identify these facilities as strictly for men or for women. Good planning will permit easy access to all areas from both men's and women's locker rooms. This type of planning permits the flexibility and adaptability necessary for efficient utilization.

Most colleges and universities cannot afford the cost of many permanent seats that are used only a few times each year. Therefore, space used in activity areas for permanent

seating of spectators should be kept to a minimum. Roll-away bleachers should be used in order to utilize efficiently the available space for spectator seating.

The health and safety of those using the areas should receive primary consideration in the planning. The aging and disabled should also be considered (see Appendix G).

Traffic patterns for the building and auxiliary facilities should be carefully studied before deciding where to locate specific activity areas.

Storage rooms for equipment and supplies used at the activity areas should be carefully planned and functionally located. These rooms should be of four types:

- The central receiving storage room, to which all equipment and supplies are delivered. This room should be accessible by truck for delivery of heavy equipment.
- Utility storage rooms located adjacent to activity areas so that bulky equipment may be moved onto the floor and back to storage with minimum difficulty. Overhead doors, or double doors with flush thresholds, should be large enough to permit free movement of heavy equipment.
- Clothing and equipment issue rooms with attendant windows opening to the locker rooms.
- Off-season storage rooms for activity equipment.

The lower portions of walls in activity areas should have a smooth, hard finish durable enough to withstand the bouncing of balls and other such abuse. The wall finish should be of a type and color that tends not to show marks and is easily cleaned.

If some activity areas are above or below ground level, an elevator should be provided for use by handicapped persons, and for the transporting of heavy equipment.

All areas designed for activity which requires dressing should be located as conveniently as possible to the locker rooms.

GENERAL-USE GYMNASIUMS

General-use gymnasium areas are utilized for basketball, volleyball, and badminton instruction as well as intramural contests in these activities. They are also frequently used for intercollegiate competition in basketball, wrestling, and gymnastics. Gymnasiums are usually rectangular and vary widely in dimensions. The dimensions of each gymnasium should be determined by the number and sizes of the various courts to be placed on the floor.

The recommended minimum amount of main-gymnasium floor space for a college or university is 25,000 square feet. The formula for the computation of the minimum floor space area for institutions having over 5,000 undergraduates is as follows: 5 square feet x undergraduate enrollment and 1.5 square feet x graduate enrollment. Although the formula is designed to indicate minimum standards, the following criteria will ultimately influence the determination of the size of the floor area: (1) the nature of the total physical education program (including intramurals and intercollegiate athletics); (2) recreational use; (3) student

¹ See Chapter 4 for additional information.

load as determined by enrollment and attendance requirements per week; (4) spectator interest; and (5) anticipated enrollment increase.

For basketball courts, backboards that swing up to the ceiling may be needed since nonfolding backboards can interfere with the court usage for other activities such as volleyball and badminton. In order to increase the number of instructional stations within the main gymnasium, electrically-controlled acoustical partitions may be installed. Wood doors or nylon or fiberglass nets may also be used.

If the gymnasium is to be used for intercollegiate athletics, seating must be provided for spectators (three and one-half square feet per person). Roll-away bleachers are recommended. Portable knockdown bleachers are not recommended because they interfere with class work while they are being erected and dismantled.

The number of seats to be provided will be determined by the size of the student body, the college community, and the degree to which there is public demand for admittance. The seating capacity should be set at a minimum of one-half to two-thirds of the student-faculty population. In larger institutions, it may be necessary to install roll-away bleacher seats in a balcony, which, when combined with the bleachers on the main floor, will provide the required number of seats. In such cases, the balcony areas can serve as additional teaching stations when the bleachers are retracted.

The varsity basketball court should be laid out lengthwise along the middle of the gymnasium. A minimum of ten feet should be left between the first row of seats, or the wall, and the outside boundary line of the court. In placing the seats and bleachers, it is necessary to plan the line of vision so that the sidelines of the varsity basketball court are plainly visible to all spectators. The folding bleachers on the floor and in the balconies should be planned to conform to the same line of vision.

If the gymnasium is to be used for intercollegiate sports, the number of entrances and exits equipped with safety exit hardware must meet local and state fire regulations and be adequate to handle spectator traffic. Spectators should be routed in such a manner that they do not cross the playing court or other activity areas in the gymnasium.

The height from the floor to the beams in the main gymnasium should be such that in normal use of any of the courts, the balls or other playing equipment will not strike the ceiling beams. This height should be a minimum of 24 feet to accommodate basketball, volleyball, and badminton.

Where intercollegiate basketball is played, there should be adequate provision for sportswriters, photographers, and television personnel. (See Chapter 4 for requirements for television, radio, and public-address systems.)

A storage room for equipment relating specifically to the main gymnasium should be located adjacent to this facility. A minimum of 400 square feet should be provided, but the final determination of size will depend on the actual use of the area. Lockable overhead doors as well as a flush threshold are suggested for this storage area.

Concrete is commonly used as a base in constructing the floor of the main gymnasium. A resilient floor is then laid on top of this base. Maple tongue-and-groove of random length is a popular type of wood finish.

It is suggested that a glazed tile or plastic paint which is durable and easily cleaned be used on the walls up to a height of seven or eight feet. From that point to the ceiling, the concrete or cinder block should be painted with a hard-finish, light-colored paint.

Direct sunlight should not be allowed to enter the gymnasium area. Translucent windows are often used, and some new facilities without any source of outside light are very

satisfactory. Skylights are not recommended.

Rebound walls are useful in gymnasiums. If constructed, they should be at least 12 feet high and made of material with good rebound characteristics.

Special consideration must be given to the eventual court layout on the main gymnasium floor so that adequate provision can be made for properly anchoring floor plates for net standards. All courts should be separated from each other and from the wall by at least ten feet. If gymnastic meets are to be held on the main floor, the exact placement of apparatus must be determined so that reinforcement of critical floor plates may be accomplished during construction.

Bulletin boards and chalkboards should be available in the main gymnasium area.

DANCE COMPLEX

The combination and relationship of areas and facilities which are developed to serve the many aspects of a dance program constitute a dance complex. The extensiveness of the complex will depend on the amount of emphasis placed on dance at the particular institution. Numerous institutions now offer dance as an undergraduate major, and many offer an undergraduate dance concentration or a minor.

Several types of facilities need to be included in the dance complex. At least one studio should be planned for multipurpose use, such as for folk, square, and social dance forms and social recreational usage. Other studios should be developed for a single purpose (e.g., a studio for modern dance and ballet). Facilities in a dance complex should be designed to serve both men and women.

In order to serve the needs of a dance program, auxiliary areas are required. These should include areas for: the making and storing of costumes, props, and scenery; the laundering, dyeing, and drying of materials; the storing of sound equipment; and the photographing and filming of dance. Planning should also include: music-listening rooms or booths; rehearsal rooms for small groups; projection, sound, and lighting booths; a box office and/or ticket booth; cloak rooms; public lavatories; and balconies or other areas for dance audiences.

Particular attention needs to be given to adequate provision for both dance performances and observation because they are essential aspects of dance education.

It is advisable to locate all facilities of the dance complex in one general area of the building, convenient to both men's and women's dressing-locker rooms. Because dance facilities are scheduled for frequent use during evening hours and weekends, supervision and control will be enhanced if the dance complex occupies a wing of the total physical education structure. The dance areas should also be readily accessible from an outside entrance to the building.

STUDIO FOR FOLK, SQUARE, AND SOCIAL DANCE

A studio designed for instructional and recreational use in folk, square, and social dance may also be used for large-group demonstrations and exhibitions as well as social-recreation occasions. An outside entrance into a main corridor of the building will provide for the traffic flow of the relatively large groups using the studio.

The size of the studio will depend on the number of individuals who will use it at any one time. An area of 5,400 square feet will accommodate a class of approximately 60 students. A larger studio of 9,600 square feet can accom-

modate approximately twice that number of students. The larger studio has the extra advantage of providing for large groups desiring to use the facility for social-recreation purposes. By installing an acoustical curtain or other dividing device, a large studio can be conveniently divided into two instructional areas.

The studio is usually rectangular, with the length and width in a ratio of approximately 3 to 2, such as 90' x 60', or 120' x 80'. The ceiling height should be in proportion to the size of the room. A 12-foot ceiling is satisfactory for a small studio. If a large studio is planned, the ceiling height should be increased to at least 16 feet.

The studio floor should be of the construction described as a "floating floor." Flooring materials should be carefully selected, and care should also be taken in laying the flooring. Special attention should be given to the floor finish. Street shoes are often worn for activities conducted in this area. For this reason, random-length, tongue-and-groove hardwood, sanded and sealed, is recommended. Nonskid-type floor finishes, such as those used on gymnasium floors, should be avoided for the studio.

Placement of sound equipment, such as record players, turntables, microphones, and speakers should be considered in the initial planning. Electrical outlets should be located where electrical equipment will be used. If the studio is to be divided into two instructional areas, the sound system should be installed to provide for separate operation of units located in each of the two areas. These two units should also be operable as a single unit. An adequate number of speakers, installed at near ceiling height, should be so located that participants at any place within the area can hear both the music and the instruction.

A lockable storage room, located immediately adjacent to the studio, should be provided for the storage of sound equipment when it is not in use. This room should have a double door, flush threshold, and built-in cabinets and shelves for storage of records, sound tapes, and musical instruments. Electrical outlets should be provided in the storage room so instructors can listen to records and tapes inside the room. It is advisable to place sound equipment on table-height stands equipped with rollers for ease of transportation.

If the studio is planned for demonstrations, roll-away bleachers should be installed at one end of the room. There should also be provision for setting up folding chairs along the walls when the studio is to be used for a social event.

Unless the dance complex includes a cloak room, racks for coats and books should be installed adjacent to entrances, either within the studio or along the outside corridor wall. The construction, finish, lighting, and other qualities of this studio should be conducive to a desirable social atmosphere.

STUDIO FOR MODERN DANCE AND BALLET

A dance studio designed specifically for the instruction and performance of modern dance and ballet is a very important feature of the dance complex.

DIMENSIONS

The space requirement will be determined by the maximum number of students enrolled in dance classes, and whether this area is to be used for performances as well as instruction. A class of 24 students can be accommodated in a space of 2,500 square feet. A larger studio, with approximately 4,800 square feet, is needed if it also serves as an informal theater and instructional area combined. This larger size can be divided into two smaller instructional

studios by installing a sound-absorbing curtain or other dividing device. A large studio, which is to be divided into small areas upon occasion, should be rectangular in shape, such as 60' x 80'. This size will provide two 60' x 40' studios for small-group instruction and rehearsals. It will also permit a minimum width of 60 feet for staging. For a single small studio, a square shape— 50' x 50' —has been found to be effective.

The ceiling height of a small studio should be a minimum of 16 feet because overhead space is required for movements involving elevation, as in leaping, for support of other dances in a vertical line, and for the use of tall props. Larger studios should have ceilings of a height proportionate to the size of the room. Full height (24 feet) is recommended for a 60' x 80' studio.

CONSTRUCTION FEATURES

The floor should be of the type referred to as "floating floor." This is necessary to provide for some shock absorption as a protection when landing from leaps, jumps, and other vigorous elevated movements. The floor should be of hardwood such as maple, and of random lengths, tongue-and-grooved. The flooring should be laid with the grain running in one direction and finished by fine sanding and then sealed. The finish should provide a smooth surface upon which dancers can glide with bare feet or soft sandals. The use of tung oil has been found to be highly satisfactory. Nonskid waxes and resins should be avoided. They not only cause feet and other bared parts of the body to stick to the floor surface, but contribute to blisters and floor burns. The floor should be cleaned with a dry or slightly-moistened mop. If the studio is to be located above other activity areas or offices, the floor should be treated acoustically to avoid transmission of sound.

Walls should be smooth-surfaced and easily maintained. They can be finished satisfactorily with a spray or brush glaze which is of permanent color and can be washed. A major portion of the walls should be unobstructed to provide a neutral background for filming.

If the lights used for general illumination also serve as houselights during studio performances, they should be controlled from wall switches as well as the light control board. Natural light through windows, particularly large ones, contributes to an aesthetically-desirable atmosphere. To avoid direct sunlight, the best location for windows is on the north wall. Windows should be curtained so the studio can be darkened when desired. This makes it possible to use the studio during daytime for film showings and matinee performances.

The temperature of the studio should be maintained at approximately 65° and the air should be well circulated. Mechanisms for the heating and circulation of air should be as nearly silent as possible to avoid interfering with the quality of sound and its reception.

A combined dance office and workroom opening into the studio can be used for consultations, class observation, and storage of sound equipment, records, tapes, and other items. The door should have a flush threshold to facilitate storing equipment when moving it from the studio. A window with a view of the studio should be installed, as should permanent storage cabinets and shelves. A small tackboard for notices, and a worktable or desk are useful features to be incorporated into the planning.

ACCESSORIES

Mirrors, which can be leaf-folded for protection during performances, should be installed along two adjoining walls

of the studio. This enables dancers to analyze movement from two directions. Where mirrors are placed on a wall, they should extend a minimum of 20 feet along the wall. Mirrors should be installed flush with the wall and raised one or one-and-one-half feet from the floor surface. Copper-backed mirrors will counteract the effect of fluorescent lighting on skin color.

Ballet barres, adjustable from 42 to 48 inches in height, should be installed permanently on at least two walls of the dance studio. These should extend from six to eight inches from the wall. The minimum allowance for length to accommodate one dancer is five feet. If permanent barre space is inadequate to accommodate all class members at once, portable barres can be utilized. Barres should be wooden and should be smooth in texture. Metal pipes have been substituted with some success. If necessary, barres can be placed in front of mirrors. This will protect the glass from damage but will add to the difficulty of using mirrors and curtaining them.

Heavy pieces of sound equipment should be placed on stands of table height equipped with rollers for ease of transportation. Since moving affects the tuning of a piano, this instrument should be placed where it will not have to be moved.

Chalkboards and tackboards will be needed and should be attached flush to studio walls. A glass-enclosed exhibit case for display of photographs, costumes, costume plates, manuscripts, and other dance materials should be installed on a wall adjacent to the studio.

The general atmosphere of the dance studio should be one which is conducive to artistic endeavors. Soft colors, clear lighting, and a sense of spaciousness will be inviting to both dancers and spectators. The studio should be equally functional and attractive.

DANCE PERFORMANCE AREAS

In designing the dance complex, provision should be made for dance performances. Although it may not be practical to include a small theater as a part of the complex, facilities to be used for instructional purposes can be designed for performances as well as instruction. The studio for modern dance and ballet is usually designed to serve both instructional and performance needs. The folk, square, and social studio can also be used for exhibitions and demonstrations in those forms of dance. A patio or other outdoor area, such as a dance green or a broad-level surface at the entrance to a campus building, can be adapted for occasional use for dance performances.

In designing a dance studio so as to make it functional for dance performances, the following guidelines should be observed:

SEATING

The entire performing area should be visible from all seats. Since a raked seating arrangement is essential, an overhanging balcony with permanently-installed seats is preferred. Entrance to the balcony can be from the balcony level or from a stairway located outside the studio. A lockable door should be provided at the foot of such a stairway. Seating should be planned for the estimated size of the audiences.

STAGING

Although arena staging is one means of staging dance within the studio area, it is less common than proscenium staging. Arena staging presents technical difficulties, such

as lighting, seating, entrance, exits, and use of scenery. A proscenium stage contains more of the features that are conducive to good performance. Whatever kind of staging is used, the surface should be of the same finish as specified for the use of modern dance and ballet instruction. Softwood areas are hazardous and should be avoided. Scenery should not be attached to the flooring by stage screws.

A proscenium stage can be provided by an installation of curtains at the front, sides, and back of the far end of the dance studio. The front curtain, when open, should provide a minimum performing area of 20' x 30'. If the studio has provisions for division into two instructional areas, the stage portion might be raised two or three feet, with the front curtain line four feet behind the raised edge to provide for an apron (forestage).

Curtains should be of a neutral or dark color which is highly light-absorbent, and they should be hung so as to touch the stage floor. The front curtain should be hand-paged because this offers more flexibility in use than does mechanical control. The back curtain should have a center opening and be hung at least three feet forward of the back wall of the studio to permit crossovers by performers. Side curtains (legs) should be installed on both sides of the stage area to provide for side entrances and exits. Asbestos teasers, hung overhead, are needed to mask border-light installations.

Battens, either wooden or pipe, to be used for hanging scenery, sky drop, or film screen, should be suspended above the visible stage area. Provision should also be made for lowering and raising battens for the attachment of scenery and the like. Lines should be attached to a pin rail located at one side of the stage.

There should be sufficient offstage space on both sides of the open stage area so performers can wait for entrance cues without being seen by the audience, or perform a fast exit without danger of running into a sidewall. Wing space is also used for offstage piano accompaniment, for quick changes, and for storage of props that are to be used during the performance. The combined wing area should at least equal the amount of the visible stage area.

Lighting equipment should be provided for side lighting, front strip lighting, overhead border lighting, front balcony or front ceiling beam lighting, and houselighting. Current practice has eliminated the necessity of footlights. Overhead border lights should be on three separate circuits so it is possible to obtain blue, amber, or red, singly or in combination. Other lighting units, except for ceiling beam lights and houselights, should be gelable so color changes can be effected. Crawl space should be provided in the ceiling, above the beam lights, to enable focusing and repair work. All light units should be on separate dimmers. A sufficient number of electrical outlets should be located in floor pockets in the wing space. A work light, installed in the right stage wing, is necessary for cueing performers and crew members. All lights should be operated from a single console within the control booth.

A system for use of tapes and recordings for dance accompaniment should be installed, preferably located within the control booth. Speakers for amplification of sound should be conveniently placed so both performers and audience can hear. An intercommunication system connecting backstage, dressing rooms, and the control booth should be included in the design. Telephones to handle outside calls should be located backstage and in the box office.

A booth for the control of lighting, sound, and projections should be constructed at the audience end of the stu-

INDOOR ACTIVITY AREAS

dio. If an overhanging balcony is included in the plan, the booth should be centered beneath the balcony. The booth requires soundproofing and a built-in counter and shelves for the use and storage of equipment. The counter should be under a window facing the stage. This enables the operator to have a full view of the stage. Providing this type of facility is far superior to operating technical equipment from one of the wings. The operator is able to make a visual check of rehearsals and performances, to correct errors, and to better control the supportive elements of a production.

Figure 4 illustrates a combined instruction-performance dance studio.

AUXILIARY DANCE FACILITIES

COSTUME ROOM

Costumes for dance performances are usually constructed rather than rented. Sufficient provisions should be made for their construction, fitting, cleaning, and storage. A room of approximately 400 square feet can accommodate a cutting

table, one or two sewing machines, a three-way mirror, ironing boards, a washing machine and dryer, a cleaning machine, two laundry tubs, portable racks for hanging costumes, and built-in storage cabinets and shelves. (Some of these items, such as laundry equipment, may be supplied elsewhere in the building.) A double door with a flush threshold will facilitate the moving of costume racks. Storage cabinets should contain racks for hanging costumes, and should be equipped with sliding doors. A tackboard and chalkboard should be affixed to one wall.

SCENE AND PROP ROOM

Although dance productions do not require full scenery, some space should be provided for the construction and storage of flats, drops, sets, and hand props. A room containing 400 square feet will usually be adequate. The ceiling should be a minimum of 16 feet in height. Since spillage is frequent, the floor should be covered with a paint-resistant surface. Ventilation should be provided to take care of fumes from paint and glue. Large double doors with flush



Figure 4
Combined Instruction-Performance Dance Studio, Brigham Young University

thresholds are needed to facilitate passage of large pieces of scenery and properties. Built-in bins and shelves for storage of nails, screws, paints, brushes, glues, and other construction materials are required. A pegboard mounted flush with the wall is useful for hanging tools. A built-in workbench, a wash sink, and tables for electrical tools should be included. A tackboard and chalkboard are needed for posting notices and for diagramming construction plans.

BOX OFFICE OR TICKET BOOTH

If admission is charged for performances, a box office or ticket booth is necessary. Racks for tickets should be included if seats are to be reserved. A built-in counter with a drawer for currency should also be provided.

GYMNASTICS AREA

The gymnastics gymnasium is used primarily for instruction and team practice. It may also be used for competition if the number of spectators is expected to be small. The area is usually scheduled so that gymnastics apparatus may be permanently placed.

Dimensions of the gymnastics gymnasium should be determined by: (1) space requirements needed to accommodate the apparatus and equipment to be installed; (2) space needs for performance in gymnastics; and (3) total college or university enrollment and interest in gymnastics. Ideally, the size of this gymnasium should approximate 10,000 square feet, with a minimum ceiling height of 24 feet. The safety of performers and instructors should receive major consideration in planning the location of apparatus, equipment, and wall fixtures. Apparatus used in performance should be located so that performers do not interfere with each other when going through their routines, and so they have full range of movement, including the approach. In planning apparatus positioning, it should be remembered the mats will be laid so as to cover completely the area of performance on all pieces of apparatus. Floor space for a 42' x 42' free-exercise mat should be considered in the floor layout.

If seating is to be provided in the gymnastics gymnasium, it should be of the roll-away bleacher type, and sufficient floor space must be added to the area to accommodate the extended bleachers and still have room to conduct a meet without having to move equipment. Storage space is a very important consideration if multiple use of the area is contemplated. A minimum of 600 square feet of storage space is required to store the usual equipment and mat trucks. There should be a flush threshold between the storage room and the gymnasium floor, and an overhead door is desirable. When space permits, the storage room provides an ideal audiovisual room for gymnastics instructors, coaches, and individual performers.

Floor plates for anchoring equipment should be recessed flush with the floor. It may be necessary to reinforce the floor to adequately install floor plates where tension from apparatus is unusually severe. Wall boards should be securely installed to the wall when equipment is attached to it. Apparatus suspended from the ceiling should be securely attached to metal ceiling supports. If the ceiling is to have concrete beams, it is desirable to have metal sleeves placed along the bottom of each beam at three-foot intervals to provide future flexibility in making attachments to the ceiling.

Doors in the area should be wide enough to accommodate the movement of gymnastic equipment to other areas. Raised thresholds should be avoided. Wall and floor con-

struction should be of the same materials as recommended for the main gymnasium. Large bulletin boards should be provided as well as some chalkboard space. It is desirable to have a large shatterproof mirror in the area where the free-exercise mat will be located. Direct sunlight should not enter the area.

WRESTLING AND PERSONAL-DEFENSE ROOM

The personal-defense room can be used for wrestling, judo, and other personal-defense instruction, team practice, and recreation. It should be located near the locker rooms and near the area in which intercollegiate wrestling competition is to be held. It should also be convenient to custodial services because of the need to keep the mats clean.

It is recommended that the room be designed to accommodate two 40' x 40' wrestling mats, with additional space for nonparticipants to walk in the area without stepping on the mats. A room 80' x 50' would be satisfactory. The standard for the computation of space needed is 140 square feet of mat per student during peak usage. The two 40' x 40' mats would accommodate a class of 24 students. A double teaching station with four 40' x 40' mats may be desired. Such an area requires a room with minimum dimensions of 80' x 90'.

The ceiling of the room should be 12 feet high. The floor is usually hardwood, or concrete covered with floor tile, to allow the room to be easily cleaned when the mats are removed. The walls surrounding the mat area should be without projections and should be padded to a height of 6 feet. Cabinets for storage should be provided, but should be located as far from the mat area as possible. All obstacles that may present hazards to participants should be eliminated.

Doors into the room should be wide enough to facilitate the removal of the folded or rolled mats. The materials used in the construction of the area should be resistant to the absorption of odor, and adequate ventilation of this area is imperative. Consideration of how the wall mats are to be hung should be made during the planning stage so that necessary preparations can be made during the construction. If polyurethane-type mats are to be used in the room, it is important to determine the coefficient of shrinkage for the mat and take it into consideration when determining the size of mat to be ordered. When this is not considered, undesirable gaps in the padded surface may result.

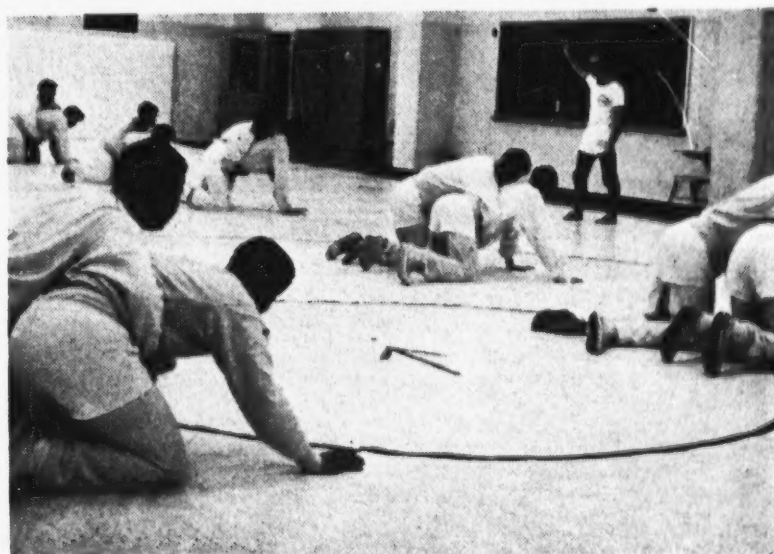


Figure 5

Wrestling Room in Gymnasium Building University of Mass.

WEIGHT-EXERCISE ROOM

The weight-exercise room may be used for instruction, recreation, and practice for competitive weight lifting. It should be located as close as possible to locker areas. The room should contain at least 2,500 square feet, with a ceiling height of 12 feet.

The floor of the weight-exercise room is usually concrete, covered with an interlocking rubber tile or similar tear-resistant and resilient material. A 15' x 15' wooden platform for the competitive lifts is usually placed on top of the resilient floor covering. Chinning bars, isometric racks, and several large shatterproof mirrors should be securely mounted in the room. Consideration should be given to barbell and weight racks that can be attached to the wall so the floor can be kept reasonably clear. The room should have at least one double door with a flush threshold to permit movement of heavy equipment.

If the weight room is to be located near other instructional areas, special consideration should be given to acoustical treatment. The room should be well-ventilated and planned so as to facilitate maintenance.

FENCING AREA

Fencing is included in the instructional, intramural, and intercollegiate programs for both men and women. An area lined with strips, or piste, should be easily accessible from the men's and women's dressing rooms. A multipurpose area with accommodations for approximately 300 spectators will usually eliminate the need for duplicating the electrical outlets and the transporting of the equipment to other areas.

A room 55' x 90' allows for four official strips 40 feet long and 6 feet wide, with 15 feet between strips. These strips may be used for informal competition and instruction. Intercollegiate competition, however, requires a 52-foot length of floor area, with a minimum of 18 feet between the strips.

For instructional purposes, the strip may be painted on a nonslip hardwood floor, be inset in linoleum, or a rubber runner of correct measurements may be laid on the floor and removed when not in use. For the electric foil and epee, a metallic piste must cover the entire length of the strip, including the extensions.

Electrical outlets and jacks should be placed at the rear of the tournament strips to provide power for the electrical equipment. If permanently-affixed wall scoreboards are provided, portable score boxes are unnecessary. Brackets or eyebolts for mounting fencing targets should be either recessed flush with the wall or placed above the seven-foot level.

The fencing area should be a well-lighted room with a minimum ceiling height of 12 feet. The installation of roll-away bleachers for spectators may necessitate raising the ceiling height, and it may also require an increased-capacity ventilating system.

An equipment room should be located adjacent to the fencing room and should be large enough to store the weapons and protective equipment used by classes. Sixty square feet is the minimal space required for storage and to accommodate a small cabinet work counter for the repair of equipment. Portable strips will require additional space, depending on the number used.

HANDBALL COURTS

Handball, paddleball, and squash can all be played in

regulation handball courts by using a removable "telltale." The official handball court is 20 feet wide, 40 feet long, and 20 feet high. The formula for determining the number of courts to be constructed is one court for each 800 students. However, a minimum of eight courts should be constructed to provide an adequate teaching battery. Detailed specifications for handball courts can be found in the official handball rule book of the United States Handball Association (see Appendix F).

When more than one court is to be constructed, the battery should be arranged so the courts are back to back, separated by a corridor approximately 10 feet wide and 8 feet high. A corridor located immediately above and at least 12 feet high may facilitate instruction or be used as a spectator gallery. Corridors and galleries should be illuminated with indirect light.

The back wall of a court need not extend higher than 12 feet. Plexiglass or other material may be used to enclose the remaining 8 feet. The use of wire mesh for this purpose is of questionable value. Most courts are satisfactorily used with an open upper rear wall.

Handball courts may be constructed of hard plaster, smooth concrete, plexiglass, or a nonsplintering, durable wood. Newly-developed synthetic materials should also be considered. While plaster is often used, it would be wise to consider courts constructed of more durable materials to reduce maintenance costs. Front walls may be constructed of hard maple laid on diagonal wood sheathing. Studding should be placed close enough to prevent dead spots. Twelve-inch stud centered wall construction is recommended. Block-constructed walls have also proved satisfactory. A costly but highly-desirable front-wall construction is to lay hard maple on edge. Side and back walls may be of nonsplintering, durable wood, such as yellow pine or hard maple. Some side and back walls constructed with one-inch, tongue-and-groove, marine plywood have proved satisfactory. All interior walls should be painted with white paint. Courts should have resilient hardwood floors.

Entrance doors should open into the court and be provided with flush-type pulls and hinges. A small shatterproof window should be installed flush with the interior surface of the door at a height of approximately five feet.

No fixtures, such as pipes, ventilating ducts, or lights should project into the playing area. Ventilating ducts and lighting fixtures (shatterproof) should be flush with the ceiling surface. Ventilating ducts should be located toward the rear of the court to minimize interference with playing surfaces. Provision for replacement of burnt-out light bulbs from above is a desirable feature.

A single light switch to control all lights in each court should be placed on the corridor wall near the entrance door. Warning lights indicating when a court is being used should be located outside each court. By use of a sturdy push-button arrangement, lights can be turned on when an entrance door is closed.

Air-conditioning, or at least forced ventilation, is essential for individual courts or for the total handball area if there is an open balcony between courts.

SQUASH COURTS

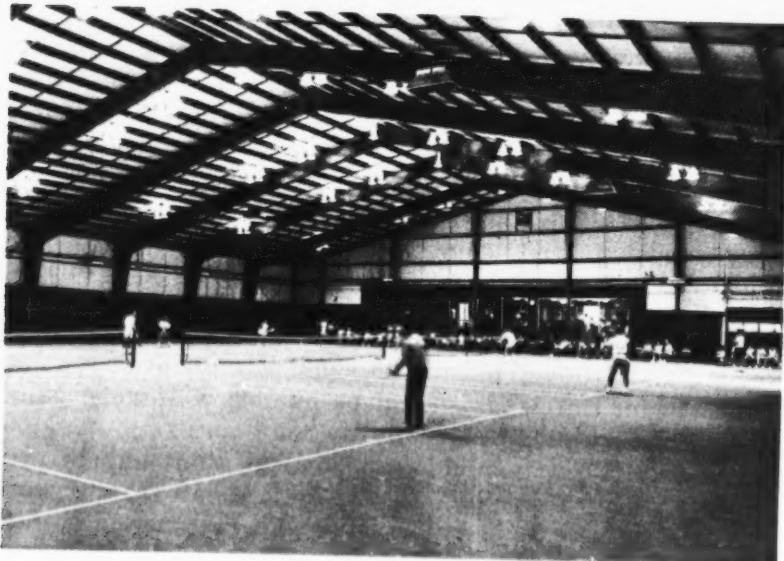
Squash courts can also be used for handball and paddleball if they are constructed with a removable "telltale," and a front rebound wall that meets the floor. Many times, squash courts are located in the same area as the handball courts.

The official singles court has the following dimensions: 18 feet, 6 inches wide; 32 feet long; and 16 feet high. The

doubles court is 25 feet wide, 45 feet long, and 20 feet high. The formula for determining the number of singles courts needed is one court for each 800 students. However, a minimum of eight singles courts should be constructed to provide a teaching battery. Few doubles courts have been constructed in proportion to singles courts, and if any are to be constructed, local interest should determine the number.

The official yearbook of the United States Squash Racquets Association (see Appendix F) and the National Squash Tennis Association should be examined before planning and constructing squash courts. Construction features of squash courts are generally similar to those of four-wall handball courts relative to floors and lighting. The walls of squash courts must be wooden. Air-conditioning of courts should be considered if year-round use is contemplated. One construction feature often overlooked is the need for a ceiling height of at least 20 feet to allow for the proper trajectory of the ball.

The use of prefabricated courts has increased in recent years. Fiberglass covering of the front wall has proved to be of value in reducing maintenance costs, as has the use of epoxy paint.



Courtesy of Parkersburg Metal Buildings, Parkersburg, W. Va.

Figure 6
Indoor Tennis Courts

INDOOR TENNIS FACILITIES

Tennis can be played indoors on any firm surface of sufficient size for a tennis court, and where court markings and a net are provided. Sometimes tennis court markings are placed on the general-use gymnasium floor and provisions are made for temporary placement of net posts, or the net is attached to rings inserted in the wall. Tennis courts might also be housed in the field house or athletic arena. Tennis is played indoors on surfaces of clay, synthetic rubberized floor covering, concrete, asphalt, and wood. The ball rebounds slightly differently from each type of surface.

A few colleges have constructed a special indoor facility specifically for tennis. If this is done, the facility should include a minimum of four courts, along with a tennis drill area. Such a facility would enable 16 students to play tennis, while other students use the tennis drill area. This approach would demand frequent rotation of students. If enough courts are desired to accommodate a class of 32 students at one time, then eight courts are needed.

If the courts are in a separate building, it should be conveniently located to locker rooms. Consideration should also be given to a covered passageway between the gymnasium and the tennis building.

Ventilation, lighting, and temperature control in this facility should be the same as for other indoor activity areas. The United States Lawn Tennis Association has published some helpful information on indoor tennis facilities.² For more details on the construction of tennis courts, refer to Chapter 8.

EXERCISE-THERAPY ROOM

A special activity area is desirable for disabled or other students who are unable to participate in regular physical education classes. In addition to its use as a remedial-exercise room, this area may serve as a teaching station for classes in body mechanics and conditioning exercises, as well as a laboratory for professional physical education students studying adapted activities and motor therapy. Other general activity areas will also be used by students in the adapted program.

The size of the exercise-therapy room should be determined by the scope of the program and the types of disabilities of those persons receiving special attention. Adapted classes are usually small. A room containing at least 1,600 square feet is required to accommodate the needed equipment and allow adequate teaching space. The ceiling of this room should be no less than 12 feet high.

The exercise-therapy room should be near the photography room, the swimming pool, and the adapted physical education office-conference room. If possible, these areas should be on the ground-floor level, with direct traffic routes to the dressing rooms and outdoor areas. If the adapted area is not at ground level, an elevator or ramps should be provided. If severely disabled individuals are to be using the room, a handrail should be installed along the ramp and hallway leading to the room. The toilet room in the vicinity should have one stall equipped with a handrail on each side (see Appendix G).

Heating, ventilation, and lighting for the unit should be planned to provide a comfortable environment. An individually-controlled thermostat should maintain the temperature from 66° to 70°, with a capacity to heat the room to 75°. The lighting should be adequate and the walls and floors attractively colored to create a cheerful atmosphere. In order to use the wall surfaces for attaching apparatus, windows should start eight feet above the floor level. Doors and windows in the area should be designed to provide privacy in the room.

The walls, ceiling, and floor of the exercise-therapy room should be constructed to support apparatus. The room should be acoustically treated. Either hardwood or vinyl-tile flooring is recommended.

Equipment installation should be planned prior to construction in order to locate apparatus attachments in the walls, ceiling, and floor. Equipment permanently installed in the room should include: stall bars, wall and overhead pulley weights, mat hangers, a press bar, weight racks, a shoulder wheel, hanging bars, suspended horizontal ladders, adjustable parallel bars, a chinning bar, climbing ropes, a posture grid screen, plumb lines, a climbing pegboard, and a walking rail. A full-length, stationary wall mirror 6 feet high and 15 feet long, with a light above it to improve vis-

² United States Lawn Tennis Association, *Tennis Courts: Construction, Maintenance, and Equipment*, 1966, pp. 45-47.

INDOOR ACTIVITY AREAS

ibility, should be mounted 6 inches from the floor. The mirror should not be obscured by wall fixtures. A full-length, three-way mirror with the side panels on hinges is desirable. The room should also have a chalkboard, tackboard, drinking fountain, lavatory, and electrical outlets for recording machines and testing devices. (See Figure 7.) A curtained area should be provided where disabled students may change their personal equipment and perform special exercises in privacy.

Storage space commensurate with the amount and types of equipment to be stored should be adjacent to the exercise-therapy room. An area with a minimum of 200 square feet is recommended. Movable pieces of equipment that may require storage include: an exercise table (plinth), stall-bar benches, a record player and tape recorder, extra weights, a low balance beam, and miscellaneous small items.

An office-conference room for private consultation and filing of records should be convenient to the exercise-therapy room. A glass, sliding panel between this office and the exercise-therapy room may be desirable.

INDOOR ARCHERY RANGE

Instructional and recreational groups need an indoor archery area that is suitable for practice during inclement weather. At the same time, indoor archery, with its mechanically-efficient automated target equipment, is being rapidly developed. The American Indoor Archery Association has

established new indoor shooting rounds and standards for 16-inch and 20-inch target faces for the automated lane.

An archery range may be established in a multipurpose activity area which has been planned so as to ensure the safe use of equipment and prevent damage to the room. In some cases, archery backdrops may also be used as ball stops for indoor golf practice. Where automated target returns are installed, however, a single-purpose area should be planned. Some commercial establishments convert bowling alleys to archery ranges during certain periods of the week. In the college or university facility, the range should be located in a heated area where foot traffic can be controlled and floodlights provide a minimum of 30 footcandles of light (70 footcandles preferred) on the target face.

An area 78 feet long is adequate for official ranges of 10, 15, and 20 yards for indoor archery, and a 20-yard range for practice with the outdoor target. The 78 feet includes 3 feet for the target, 60 feet for the range, and 15 feet for walking space behind the shooting line. An area 65 feet wide is required for 24 students. This area will accommodate six 48-inch targets set 10 feet apart on centers, or twelve 5-foot lanes for indoor targets. A minimum ceiling height of 10 feet should be provided between the shooting line and targets.

The floor in the archery area will receive hard usage from street shoes and flying arrows. A hardwood, tongue-and-groove floor, with the boards running the length of the shooting area, is preferred. A wooden floor is damaged

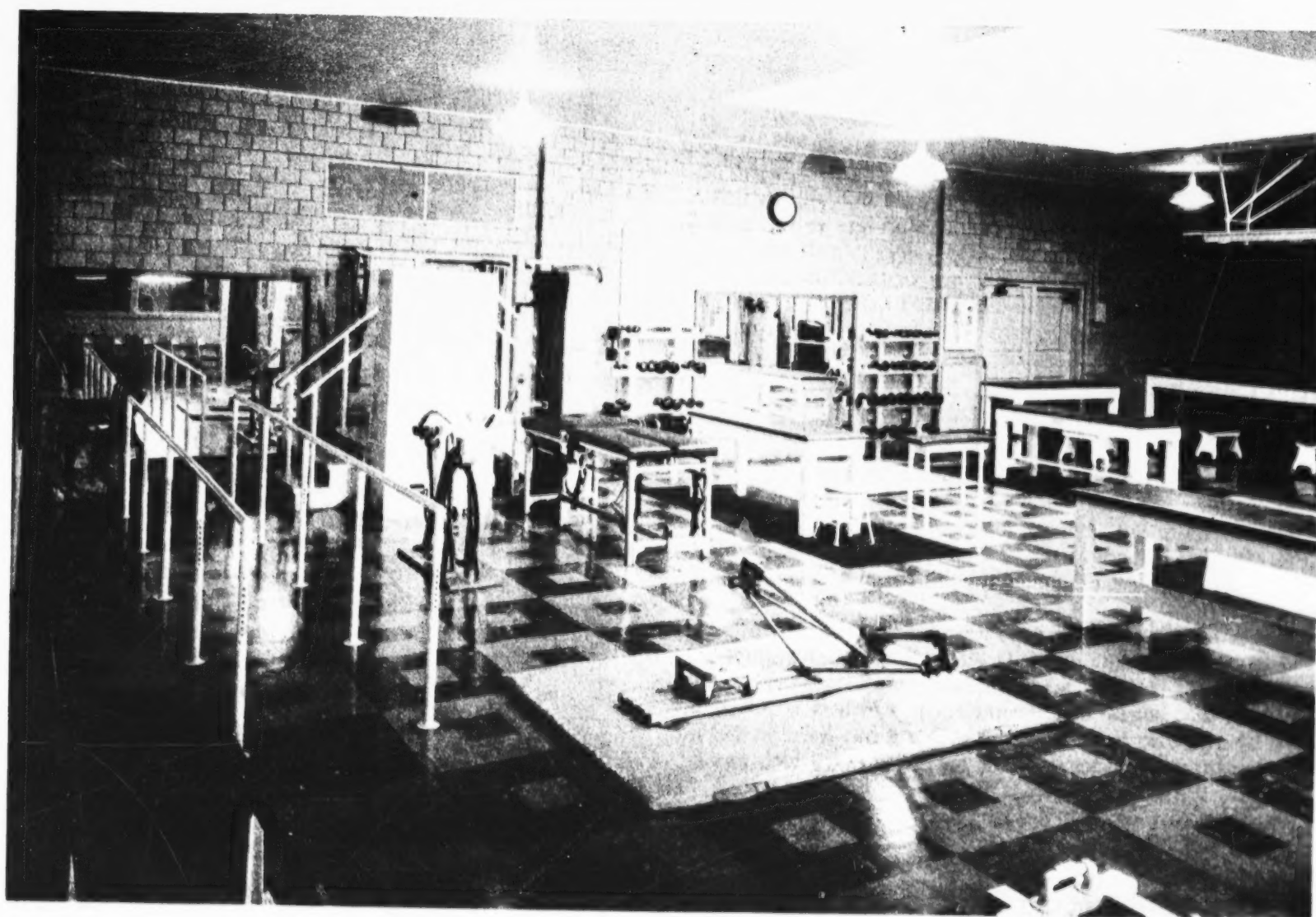


Figure 7
Exercise-Therapy Room, University of Illinois

less by arrows, and, at the same time, it helps reduce arrow breakage. A rug or hard-rubber runners may be placed along the shooting lane if desired.

The location of structural features in the archery room should be given careful attention. Obstructions ahead of the shooting line, such as supporting pillars and overhead lights in a low ceiling, should be recessed or otherwise protected from flying arrows. The area behind the target should be covered with a backdrop to protect the wall and prevent arrow breakage. A large heavy run, or a commercially-available nylon net which arrows cannot penetrate, may be used. All doors and windows in the area should be located behind the shooting line. The same is true for tackboards and chalkboards.

Targets may be affixed to the backstop or placed on easels in front of it. A variety of targets are available, including straw, double-curl excelsior, and styrofoam with composition centers. The target should be constructed and placed so as to allow an arrow to penetrate at least 20 inches without striking any obstruction that would damage the arrow.

In a multipurpose room, target holders should be mounted on wheels or set in floor plates. The plates should be flush with the floor when the target holder is removed. The backdrop behind the targets should be pulled to the side or rolled overhead when not in use.

Storage space for targets and other equipment should be adjacent to the range. The size and location of storage areas will be determined by the type of targets used. Heavy straw targets require a large storage space near the target area; light-weight targets on aluminum frame may be stored with the bows. Racks for hanging bows, and shelves for storing arrows should be included in a storage area behind the shooting line. This location enables a student to replace or exchange equipment while other students continue to shoot.

The feasibility of installing automated lanes should be seriously considered. Several types of commercial lanes are available. Automated lanes have lane dividers at the shooting line and an automatic warning system to halt shooting in the event a person steps in front of the shooting line. Electric target-returns bring the targets to the shooting line so arrows can be removed, and the targets can be adjusted for different shooting distances without altering the shooting line.

RIFLE RANGE

A rifle range can be used for class instruction, competitive shooting, and recreation for both men and women. On campuses where it is deemed unfeasible to include a range within the physical education complex, the department might collaborate with ROTC units on the campus in constructing a range.

A room 75' x 42' will accommodate eight firing points, or a class of 24 students. At least eight firing points are recommended on the basis of one point for every three members of a class. Additional room width is required if more firing lanes are desired. The National Rifle Association standard shooting distance for rifles is 50 feet, measured from the firing line to the target. The bulletstop should be 6 to 10 feet beyond the target. This space varies with the type of installation.

A minimum of 15 feet is required behind the firing line for mats, scoring tables, rifle racks, and walking space. The ceiling should be 8 feet high in front of the firing points. This ceiling height reduces the amount of wall space that must be covered behind the backdrop, and facilitates the in-

stallation of target carriers. Each firing point should be at least 5-1/2 feet wide.

The wall at the target end of the range should be bullet-proof. Bulletstops should be made of heavy steel or armor plate. Masonry and wood should not be used for bulletstops. Masonry will chip, causing dangerous ricochets, and wood becomes chewed up by the slugs. The required thickness of the steel plate used for the bulletstop depends upon the caliber of ammunition used, with the required thickness increasing as the caliber of the weapon increases. If only .22 caliber ammunition is used, 3/8-inch plate should be installed.

The backstop should be behind and angled down and away from the target at a 45-degree angle (see Figure 8). The sidewalls of the bulletstop should be steel plate to protect the wall from the spatter of lead from the backstop. A sandbox, 8 inches deep and 6 feet wide, running the full width of the range, should be placed on the floor beneath the bulletstop to catch deflected lead. This type of bulletstop requires 8 feet of space. A bulletstop made of louvered steel plate requires somewhat less space.

The target carrier is a pulley device that runs the target back and forth between the firing line and the backstop, thus eliminating the need for the shooters to step in front of the firing line. The target frame and carrier may be constructed locally or purchased from commercial manufacturers specializing in this field. The carrier should provide for targets at two heights, one for the standing position at 5 feet, 3 inches high, the other at 1 foot, 6 inches high for the

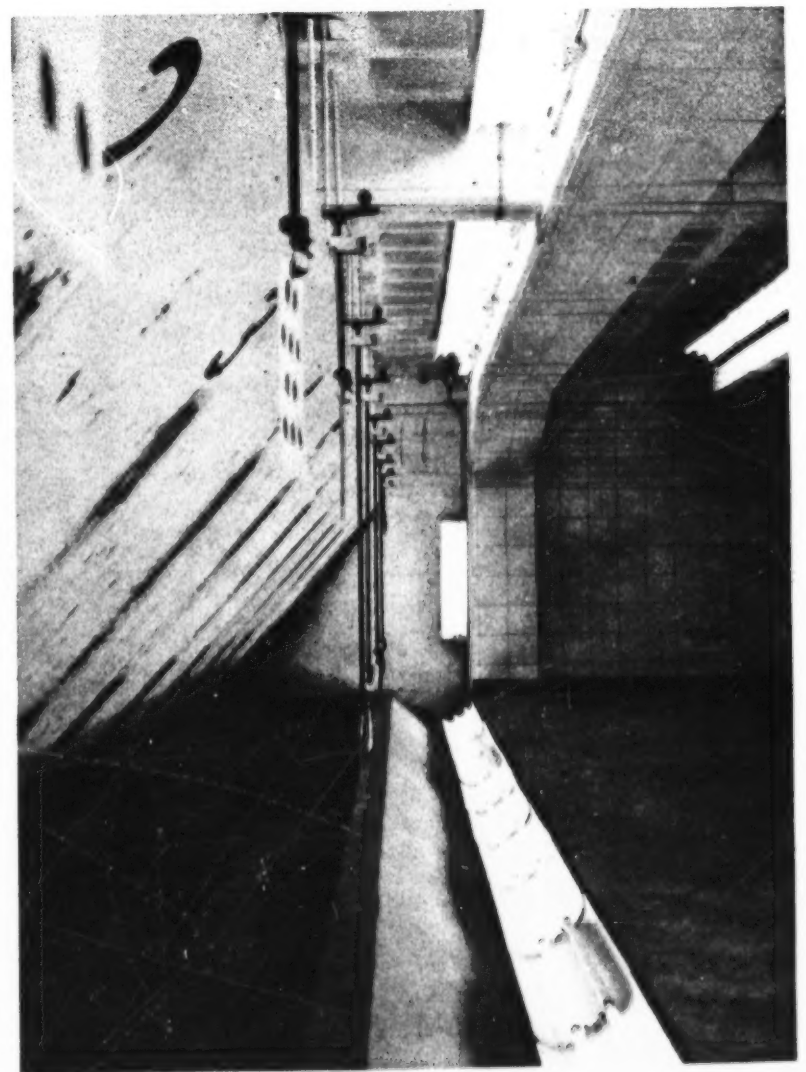


Figure 8
Pit Area of Rifle Range, University of Maryland

INDOOR ACTIVITY AREAS

prone, sitting, and kneeling positions. The lower-level targets are usually provided by a detachable extension rod from the upper targets.

Special attention should be given to the lighting, ventilation, and acoustics of the range. It is essential to have uniform lighting from strategically-located lamps to eliminate undesirable shadows, reflections, and brightness contrasts between the target and the surrounding space. The light intensity should gradually increase down the range, from a minimum of 50 footcandles at the firing line to 70 footcandles on the vertical target. Lights focused on the target are placed above and below the target. Exposed lamps should be protected by steel plating with a wood facing. The color of the backstop, walls, and ceiling should be light tan or off-white, similar to the paper on which the targets are printed. Nonglossy paint should be used to reduce glare.

The range should be provided with sufficient ventilation to keep it reasonably free of gunpowder fumes. The ventilating ducts should not transmit the sound of gunshot to other areas of the building. The range will require acoustical treatment, with the walls and ceiling around the firing points receiving special attention. Acoustically treated doors should be designed to prevent the transmission of noise. There is no need to have windows in the room. The acoustical materials and all surfaces around the firing point should be fireproof and fire-resistant. Reinforced concrete is recommended for the floors and walls of the range.

Exposed beams, lamps, conduits, or any projecting surface in front of the firing point should be covered with protective steel plates faced with wood two inches thick. The steel plate will protect the exposed part from bullets and the wood facing will prevent ricochet. The facing should be set at such an angle that a bullet could not possibly return to the firing point.

A lockable arms and ammunition storage unit should be located immediately behind the firing line. The size of the unit will depend upon the number of firing points and the variety of weapons employed. Storage space is also needed for a mat for each firing point, target faces, and other small items of equipment.

The only entrance to the room should be from behind the firing line. Since the doors must be closed while the range is in use, a small viewing window in the door, starting at

the five-foot level, is helpful. Tackboards, chalkboards, a telephone jack, and light-control switches should be installed behind the firing line.

For specifications on construction of backstops and target carriers, and for steel plate thicknesses for a particular caliber of ammunition, write to the National Rifle Association of America, 1600 Rhode Island Avenue, N.W., Washington, D.C. 20036.

INDOOR GOLF-PRACTICE AREA

Provisions can be made to accommodate golf practice indoors. Balls may be hit into a large durable nylon net or canvas placed several yards in front of the hitting positions. Driving cages such as those pictured in Figure 9 may also be used. Hitting positions may be established by placing matting, such as a large door mat, on the floor, with a smaller piece of artificial turf on top of the mat. The golf ball is then played from the turf.

Indoor greens can be constructed by laying artificial turf over a solid surface, and placing one or more cups in the desired location (see Figure 10).

BOWLING LANES

Bowling lanes in a physical education complex can be used extensively for instruction, recreational bowling, and competition. A minimum of eight lanes should be constructed to provide an effective instructional unit. With four students per lane, eight lanes will accommodate a class of 32 students. The lanes should be located for convenient access during both day and evening hours, and where noise from the pins will not interfere with other classes. It is not especially important to locate the lanes near dressing and shower rooms, as recommended for other activity areas.

The construction of bowling facilities is a complex architectural and engineering task. Therefore, specialists should be consulted and brought into the planning at an early date. Major suppliers of bowling equipment will provide excellent architectural consultation and research services.

Examples of common errors which may be eliminated by expert planning are:

- Support columns on or near the approach areas (clear-span roof structure is an important feature)

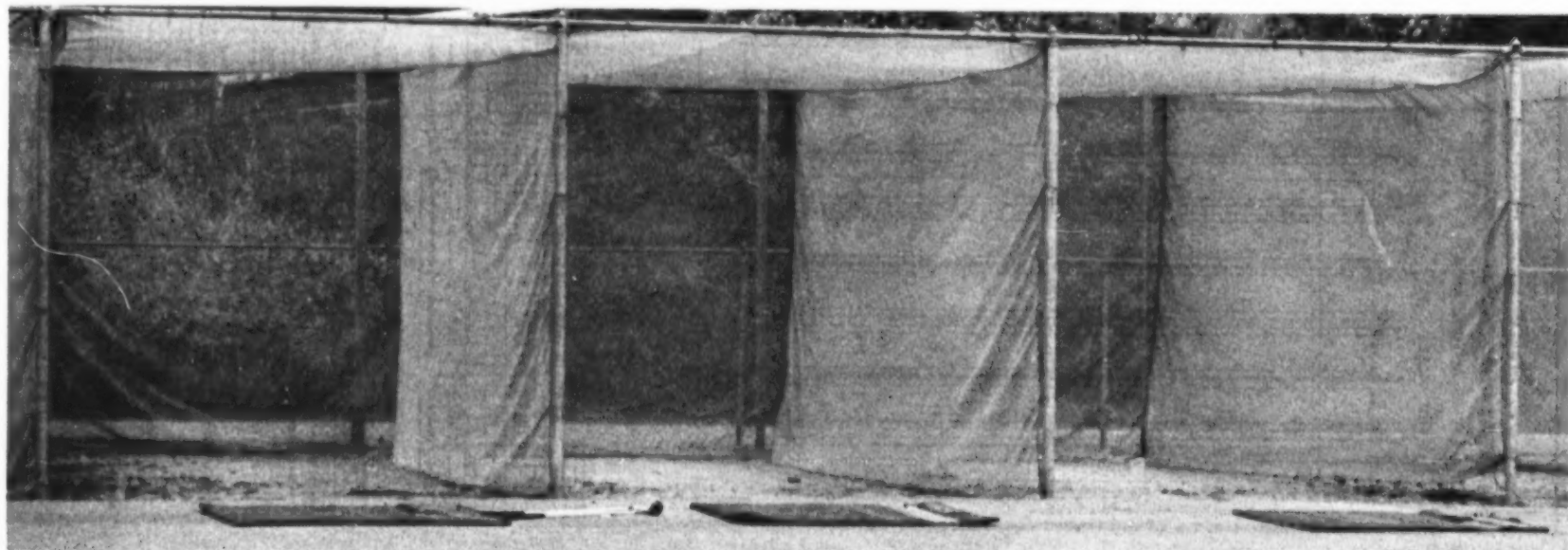


Figure 9
Golf Driving Cages for Indoors or Outdoors

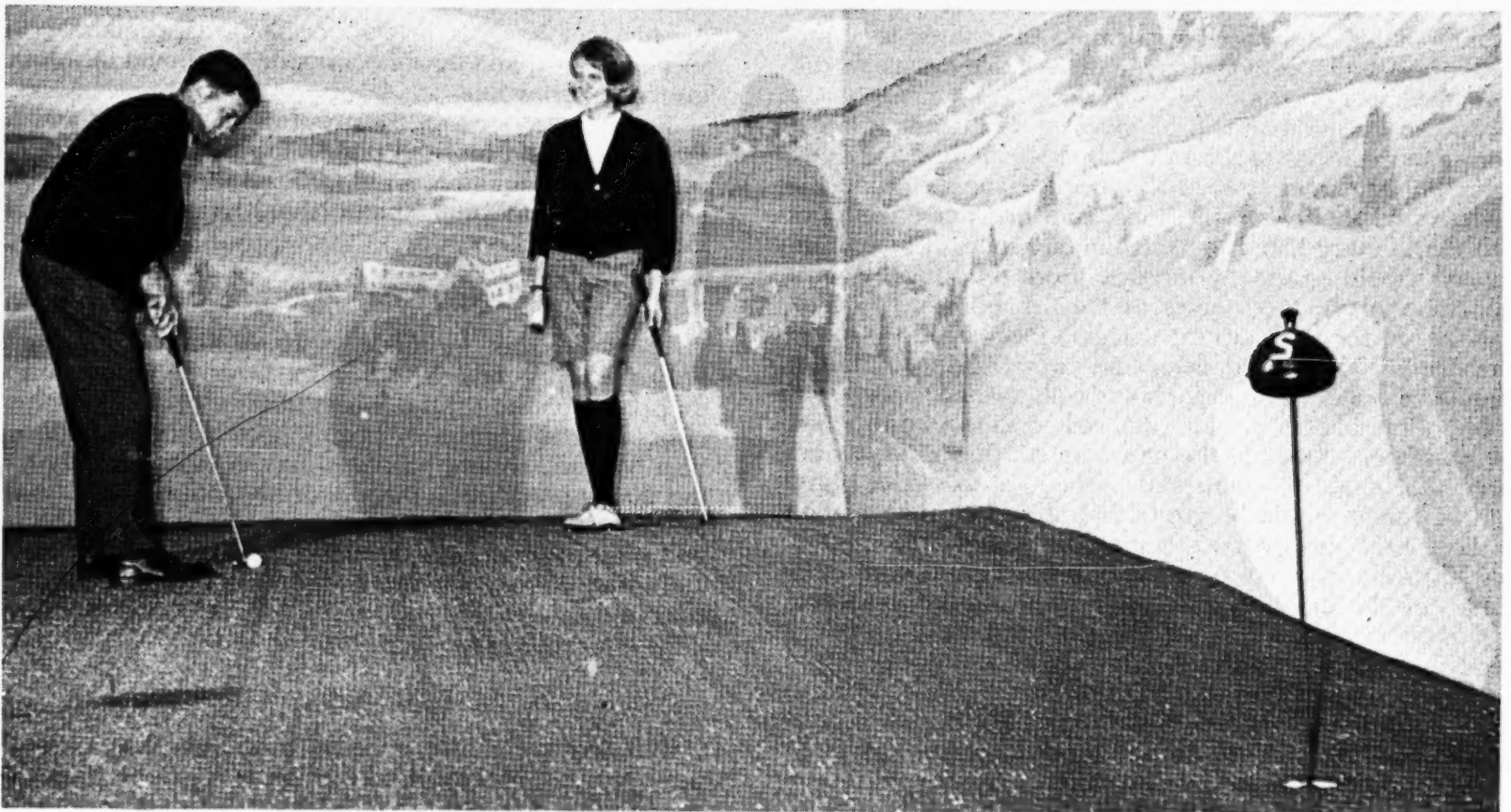


Figure 10
Indoor Golf Green

- Poorly-planned lanes and pits which permit distracting noise, inadequate or uneven light, or glare
- Drab or discordant color combinations
- Fluctuating room temperature and humidity due to varying numbers of people
- Poorly-planned service areas
- Poor maintenance provisions

The ceiling height of the room should be a minimum of 10 feet, with 12 feet strongly recommended. The width of the facility is dictated by the number of lanes. A lane, including gutters, is 60 inches wide. Eight lanes, including lane dividers and four ball-return chutes, require a minimum width of 44 feet, 8 inches. Space for a passageway to the pits must be added to this.

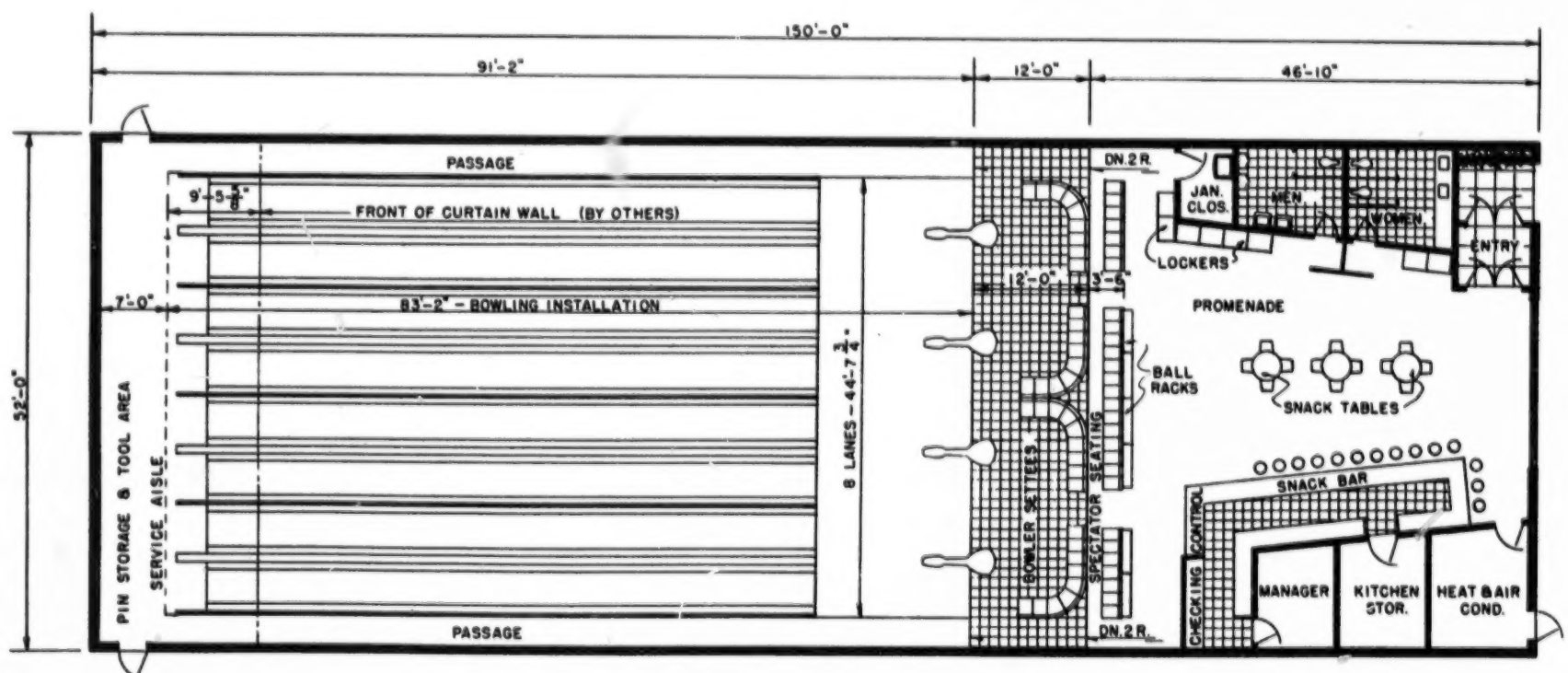
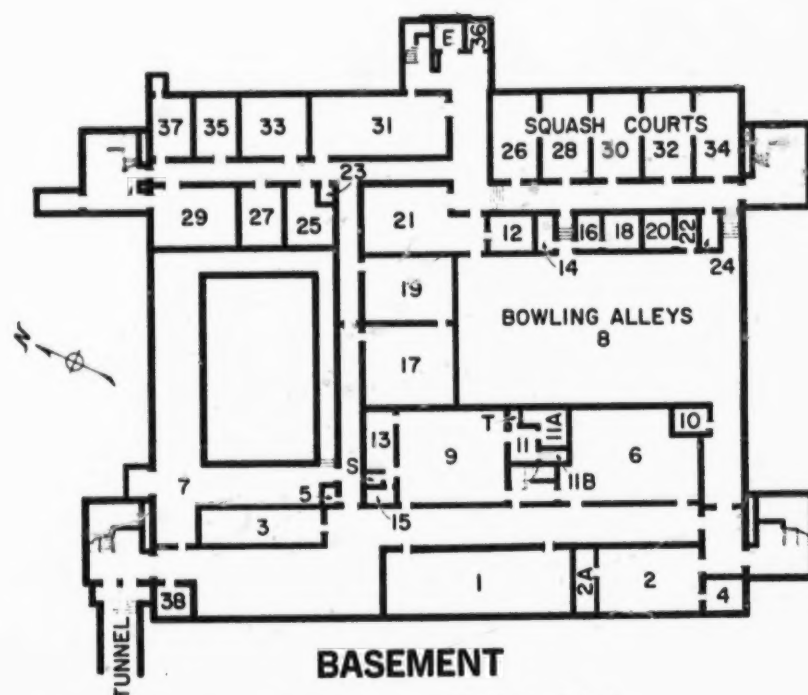
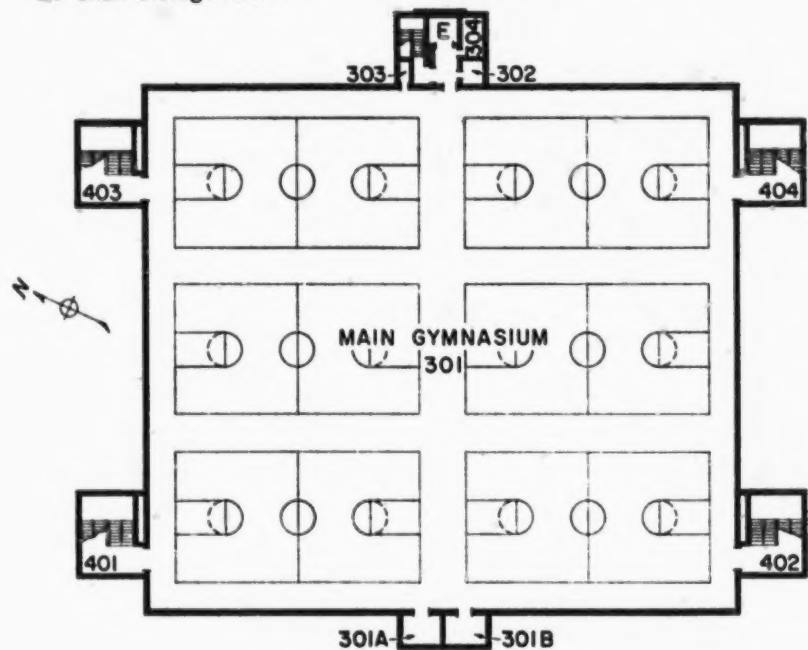


Figure 11
8-Lane Bowling Installation

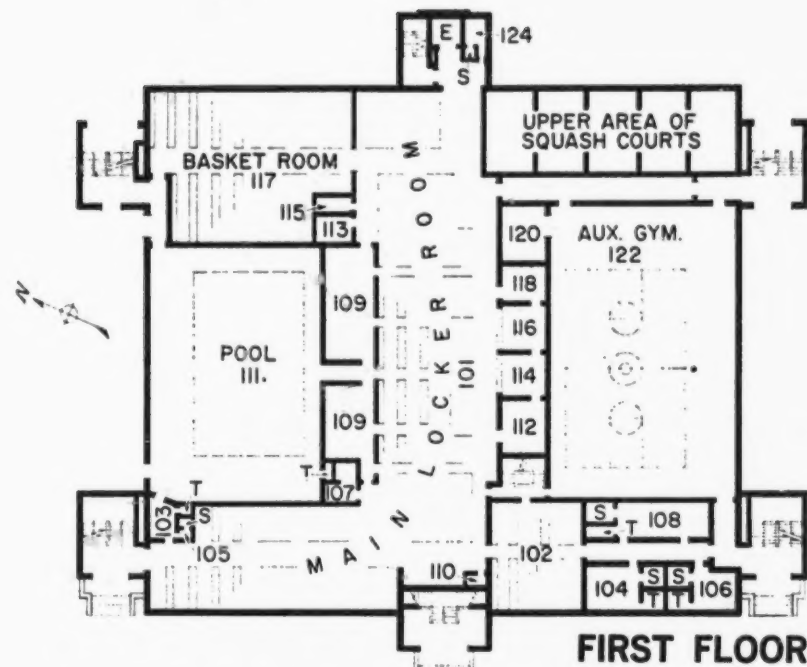
INDOOR ACTIVITY AREAS



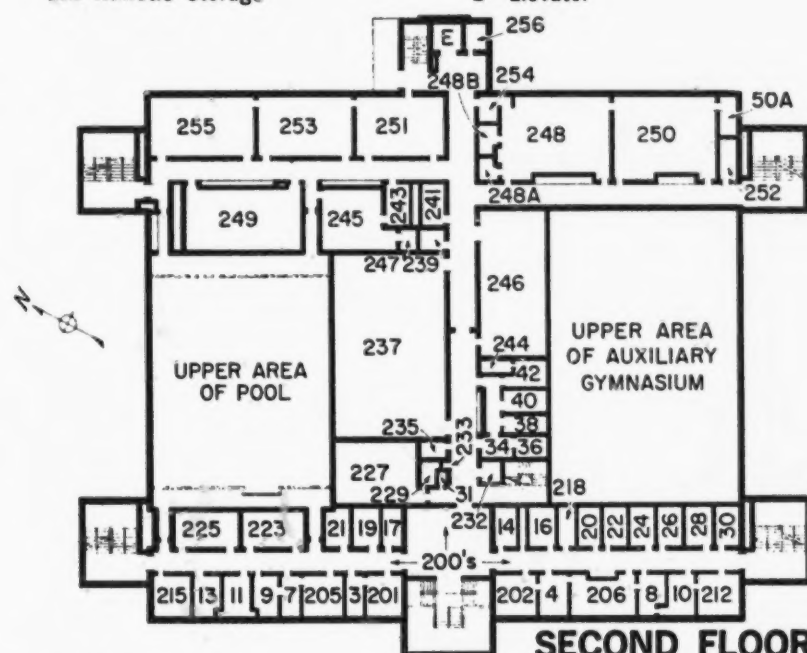
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|-------------------------------------|------------------------------|
| 1 Graduate Research Area | 22 Men's Toilet |
| 2 Physiology of Exercise Laboratory | 23 Men's Toilet |
| 2A Physiology of Exercise Storage | 24 Mechanical Equipment Room |
| 3 Storage | 25 Storage |
| 4 Office | 26 Squash Court |
| 5 Janitor's Closet | 27 Storage |
| 6 Weight Training Room | 28 Squash Court |
| 7 Filter Room | 29 Maintenance Room |
| 8 Bowling Alleys | 30 Squash Court |
| 9 Physiotherapy Room | 31 Laundry |
| 10 Bowling Alley Office | 32 Squash Court |
| 11 Physiotherapist | 33 Steam Room |
| 12 Storage Room | 34 Squash Court |
| 13 Whirlpool Room | 35 Electrical Equipment Room |
| 14 Janitor's Closet | 36 Elevator Machinery |
| 15 Steam Bath | 37 Transformer Room |
| 16 Women's Toilet | 38 Equipment Storage Room |
| 17 Driver Education Laboratory | |
| 18 Emergency Women's Toilet | |
| 19 Classroom | |
| 20 Emergency Men's Toilet | |
| 21 Chair Storage Room | |
- S—Shower
T—Toilet
E—Elevator



- MAIN GYMNASIUM**
- | | |
|--------------------|-----------------|
| 301 Main Gymnasium | 401 } Fan Rooms |
| 301A Storage | 402 } |
| 301B Storage | 403 } |
| 302 Women's Toilet | 404 } |
| 303 Janitor | |
| 304 Men's Toilet | |
- E—Elevator

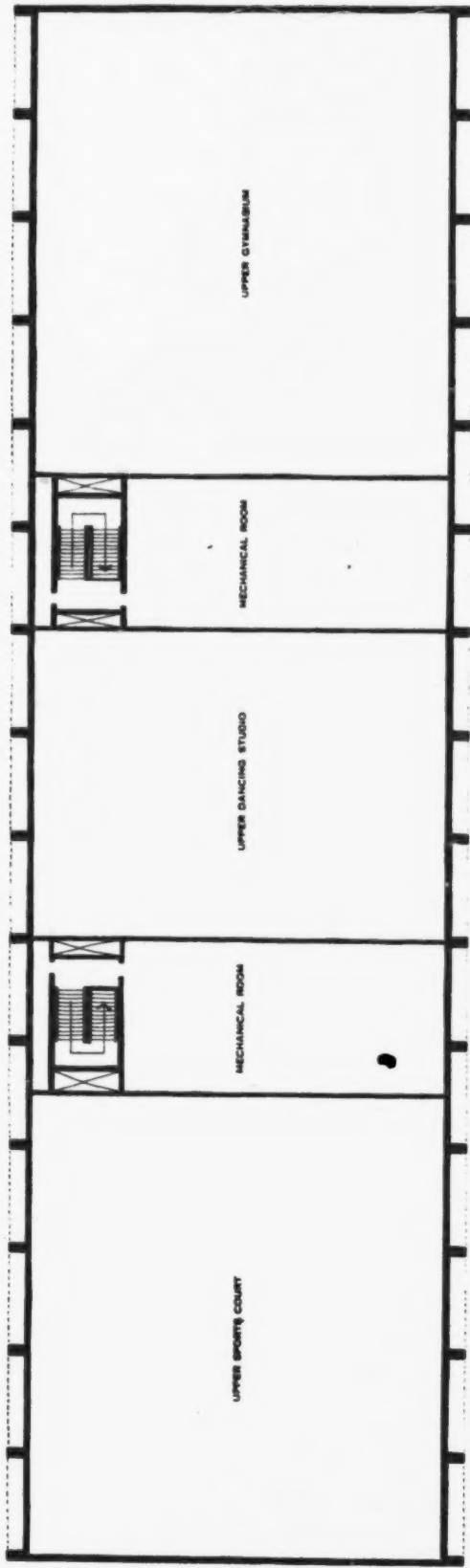


- | | |
|--|-------------------------------------|
| 101 Main Locker Room | 113 Toilet |
| 102 Varsity Locker Room | 114 Athletic Issue Room |
| 103 Swimming Pool Office | 115 Janitor's Closet |
| 104 Visiting Team—Locker Room | 116 Physical Education Issue |
| 105 Dressing Room | 117 Basket Room |
| 106 Physical Education—Faculty Locker Room | 118 Physical Education Storage Room |
| 107 Toilet | 120 Auxiliary Gymnasium Storage |
| 108 Faculty Locker Room | 122 Auxiliary Gymnasium |
| 109 Main Shower Room | 124 Janitor's Office |
| 110 Janitor's Closet | |
| 111 Pool | |
| 112 Athletic Storage | |
- S—Shower
T—Toilet
E—Elevator

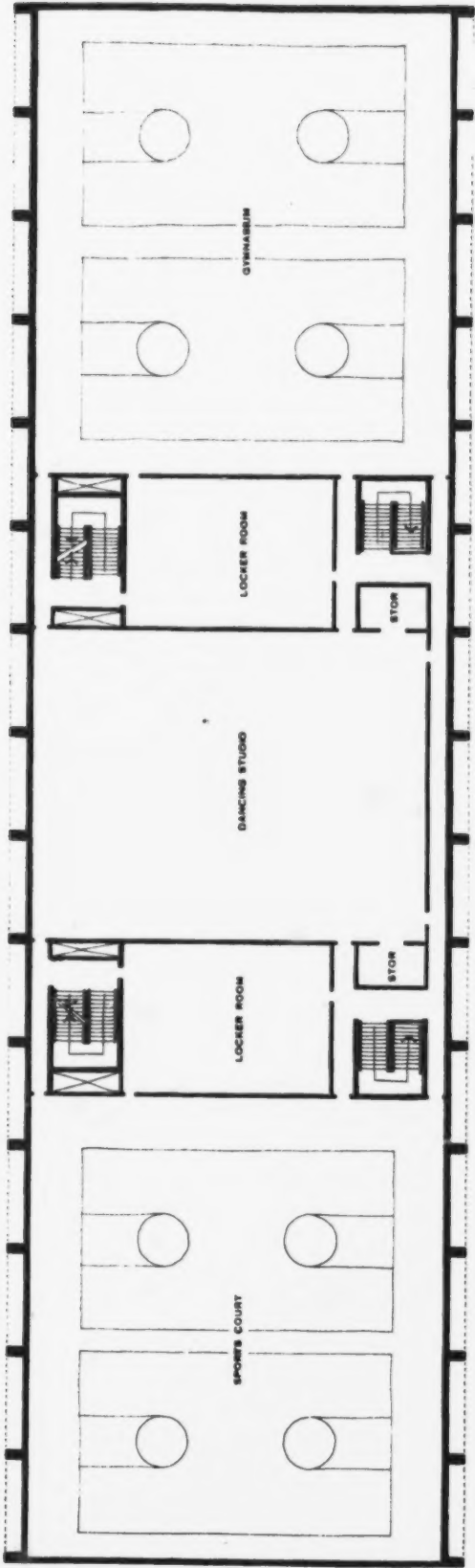


- | | |
|-------------------------------------|------------------------------------|
| 200 Main Lobby | 247 Women Instructor's Locker Room |
| 214 Men's Toilet | 248 Laboratory |
| 216 Women's Toilet | 248A Lab—Storage |
| 223 Seminar Room | 248B Lab—Storage |
| 225 Seminar Room | 249 Classroom |
| 227 Audio-Visual Classroom | 250 Laboratory |
| 229 Projection Room | 250A Lab—Storage |
| 231 Ticket Booth | 251 Classroom |
| 232 Mechanical Equipment Room | 252 Audio-Visual Storage |
| 233 Public Telephone | 253 Classroom |
| 235 Janitor's Closet | 254 Calculating Machine Room |
| 237 Wrestling Room | 255 Classroom |
| 239 Janitor's Closet | 256 Janitor's Office |
| 241 Men's Toilet | |
| 243 Women's Toilet | |
| 245 Women's Locker Room | |
| 246 Adapted Physical Education Room | |
- E—Elevator
- All other numbered rooms are offices.

Figure 12
Men's Gymnasium Building, University of Massachusetts

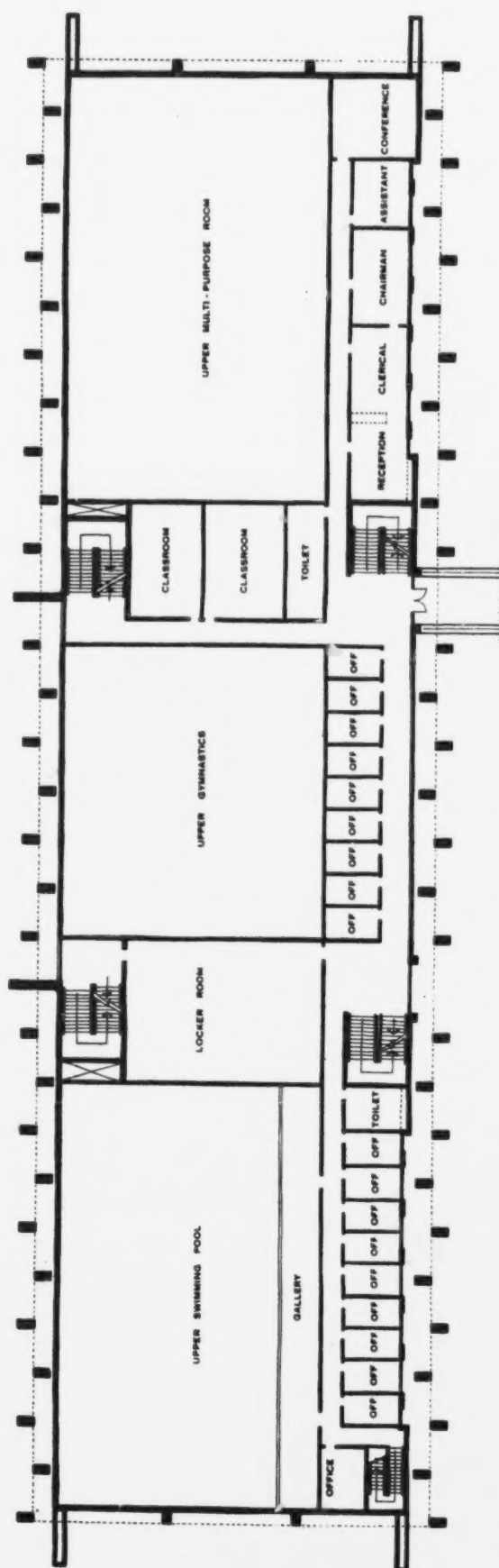


FOURTH FLOOR PLAN

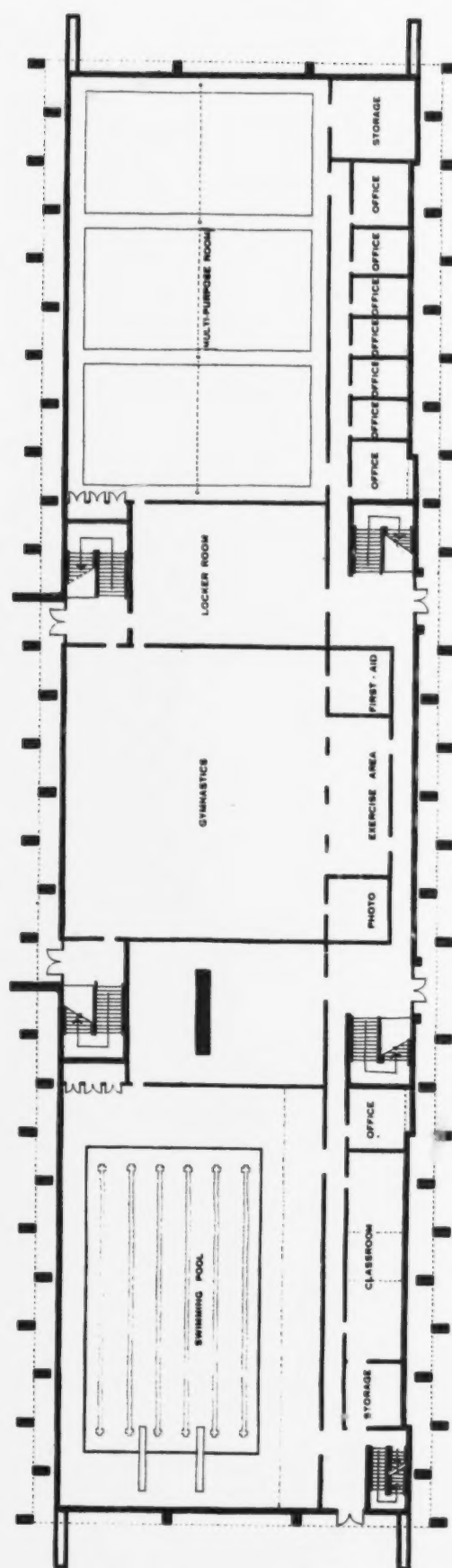


THIRD FLOOR PLAN





SECOND FLOOR PLAN



FIRST FLOOR PLAN



Figure 13
Women's Gymnasium Building, University of Nebraska

The total length of the bowling room is determined by the length of the lanes plus additional space needed for storage and repair shops at the rear of the building and for service areas in the front of the building. The distance from the foul line to the end of a lane is 63 feet. At least 10 feet additional space is required for pinsetting machines and the pit service area. A minimum of 15 feet is required for the approach. Therefore, the pit service area, pits, bed, and approach require a minimum length of 88 feet. Another 9 to 12 feet should be added for bowlers' settees, depending on the particular type used. Spectator seats are recommended and each row of such seats will require an additional 3 feet, 6 inches. Other features which should be included and will require additional space are: (1) conveniently-located rest rooms; (2) the control and sales area; (3) shoe-rental areas; and (4) storage space near the pits for extra pins and other such items.

A manager's office of at least 100 square feet, with windows offering a view of the lanes, should be provided. The office should have Dutch doors with a large counter, or a half-height raising door over a counter. The management should be able to supervise the exits and entrances as well as all of the bowling lanes from the control area. An intercommunication system and switches used to control the houselights and to activate the bowling equipment should also be located in this control area. Special attention should be given to proper ventilation and sanitation of the shoe storage and rental area. Ball racks mounted on rollers or permanently placed must be provided. A passageway with a door wide enough to allow movement of pinsetting machines should be located so as to facilitate the moving of heavy equipment to the pits.

The need for even light intensity on the lanes is paramount. The recommended footcandle intensities are as follows: 15 to 25 footcandles on the beds, 8 to 15 footcandles on the approach, and 35 footcandles over the automatic pinsetters. If television lighting is needed, separate circuit wiring divorced from other house activity is recommended (see Chapter 4).

A public-address system for general announcements and instruction is desirable. An intercommunication system is very important because it can save steps and time. Such a system aids the management in communicating with mechanics and other personnel in the pits. Background music equipment may also be installed and should be controlled from the main counter.

Because of the great fluctuation in the number of people in the room, fully-automatic control of both temperature and humidity is highly desirable. Local weather conditions must be carefully considered in planning controls for temperature and humidity.

The sound of crashing pins is inspiring to the bowler. Other noises should be reduced to a minimum. To effect this, the floor should be firm and solid, with no space between the floor layers. Many forms of acoustical materials may be used on the ceiling and walls with reasonable success. Bowling-supply manufacturers can provide information on the best material to use. As a general rule, noise-reduction coefficients of .70 to .85 in the pit area of the lanes, and of .50 to .65 for the balance of the lane areas are considered satisfactory. A .65 to .75 noise-reduction coefficient is considered satisfactory for the control and management area.

SELECTED REFERENCES

- American Indoor Archery Association, *Mimeographed Rules*. Chicago: The Association, 23 East Jackson Boulevard, Revised 1965.
- Bischoff, David C., "Designed for Participation," *Journal of Health, Physical Education, and Recreation*, March 1966.
- Castello, Hugo, and Castello, James, *Fencing*. New York: The Ronald Press Company, 1962.
- Daniels, Arthur S., and Davies, Evelyn A., *Adapted Physical Education*. New York: Harper and Row Publishers, 1965.
- Department of Public Instruction, Commonwealth of Pennsylvania, *Guidelines for Adapted Physical Education*. Harrisburg, Pa.: Department of Public Instruction, 1965.
- Gabrielsen, M. A., and Miles, C. M., *Sports and Recreation Facilities for School and Community*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1958.
- Kelly, Ellen D., *Adapted and Corrective Physical Education*. New York: The Ronald Press Company, 1965.
- National Industrial Recreation Association, *Standard Sports Areas for Industrial, School, Private, and Public Recreation Leaders*. Chicago: The Association, 1963.
- Participants in National Facilities Conference, *Planning Areas and Facilities for Health, Physical Education, and Recreation*. Chicago: The Athletic Institute, and American Association for Health, Physical Education, and Recreation (NEA), 1965.
- "Physical Education Facilities," *School Management Magazine*, December 1966.
- Scott, Harry A., and Westkaemper, Richard B., *From Program to Facilities in Physical Education*. New York: Harper and Brothers, 1958.
- United States Lawn Tennis Association, *Tennis Courts: Construction, Maintenance, and Equipment*. New York: The Association, 1966.

Chapter 7

INDOOR AND OUTDOOR SWIMMING POOLS

The vast expansion in aquatics which has occurred during the past two decades in the United States places new demands upon planners of college and university facilities for health, physical education, and recreation.

General considerations in pool planning and construction are normally the same for aquatic facilities in schools and communities. However, certain special features at the college and university level must be given consideration in order to make possible an extensive educational, competitive, and recreational aquatic program. This chapter has been developed to aid pool planners in designing facilities which will be adequate to meet the present and future aquatic needs of the particular institution.

DESIGN AND PURPOSES

The college or university swimming pool or natatorium should be designed to serve the present and projected future needs of the specific college community. It should help to meet the basic objective of the institution's program in health, physical education, and recreation. In brief, this objective is to promote the total development of individual members of the college or university community physically, mentally, spiritually, and socially. In some cases, college or university facilities may be designed to serve the additional needs of the residential community adjacent to the campus.

The college or university aquatic facilities should be planned in the light of the aquatic program to be offered. In order of priority, it is important to program for swimming instruction, lifesaving and water safety, competitive swimming, the adapted aquatic program, aquatic research, and recreational aquatics for the college community. Additional aquatic programs can be planned for members of the residential community in situations where such programs are desirable and feasible.

If the aquatic program is to include competitive swimming, the pool should be designed according to the following specifications of the National Collegiate Athletic Association and the Amateur Athletic Union: rectangular and 75' x 45' minimum, containing six 7-foot lanes. For markings, refer to current rule books.

The pool depth should range from 3 1/2 or 4 feet to 9 or 12 feet, according to the type of diving-board installation. This size pool should have not more than two 1-meter boards, or one 1-meter and one 3-meter board. If there are diving boards of different heights, they should be placed so there is a lateral distance between them of at least 10 feet, measured from the midpoints of the boards. Boards should also be placed 10 feet in from the sides of the pool.

There is a growing trend toward building the Olympic-size pool—50 meters x 75'-1"—with eight lanes (see Figure 14). Consideration should also be given to a pool with an overall depth of five feet. This type of construction does not permit the use of diving boards and is not suitable for classes of nonswimmers. Some 50-meter pools incorporate movable bulkheads which permit greater flexibility in use of the facility.

If the program design does not include competitive swimming, the pool sizes and shapes recommended above are still desirable because they are the most functional.

The multiple-unit aquatic facility is most desirable and may include an instructional pool, a diving well, and a competitive pool. If only one pool is to be built, its multipurpose character will have to meet the needs of the program design as fully as possible.

From the standpoint of flexibility, if the program is broadly conceived, it may be desirable to build pools which can be used for coeducational or all-male and all-female groups. All aquatic facilities should be designed so as to meet the structural regulations of the Division for Girls' and Women's Sports (AAHPER), the National Collegiate Athletic Association, and the Amateur Athletic Union.

THE PROGRAM

The pool planning committee should carefully review the program requirements before attempting to determine the kinds of aquatic facilities needed to satisfy these requirements. The list below suggests possibilities which may aid planning groups in the development of adequate aquatic programs:

- Classes for undergraduate students in swimming, diving, lifesaving and water safety, synchronized swimming, and skin and scuba diving
- Special classes for the disabled, post-operative cases, excessively timid nonswimmers, and slow learners, and for adapted physical education classes
- Recreational-swimming periods for students, faculty, and other college or university personnel
- Make-up swimming periods for students who have had excused absences
- Practice periods for intramural and varsity swimming team groups
- Practice periods for team diving groups
- Practice periods for synchronized swimming club groups
- Boating and canoeing classes
- Assignments for home team competitive meets, water shows, demonstrations, clinics, and other special events
- Classes for faculty children
- Programs for the college or university community
- Programs for college or university residential groups

INVOLVEMENT OF PROGRAM PERSONNEL

All people should be involved in the preliminary planning who will later become part of an operative program. An efficient method is to appoint a committee of faculty members who are conversant with aquatics. This committee will need to:

- Examine the existing aquatic facilities of the college or university
- Determine future needs
- Familiarize themselves with the space and site allocated for new aquatic facilities

Multiple Units

Single-Unit All-Purpose Facility

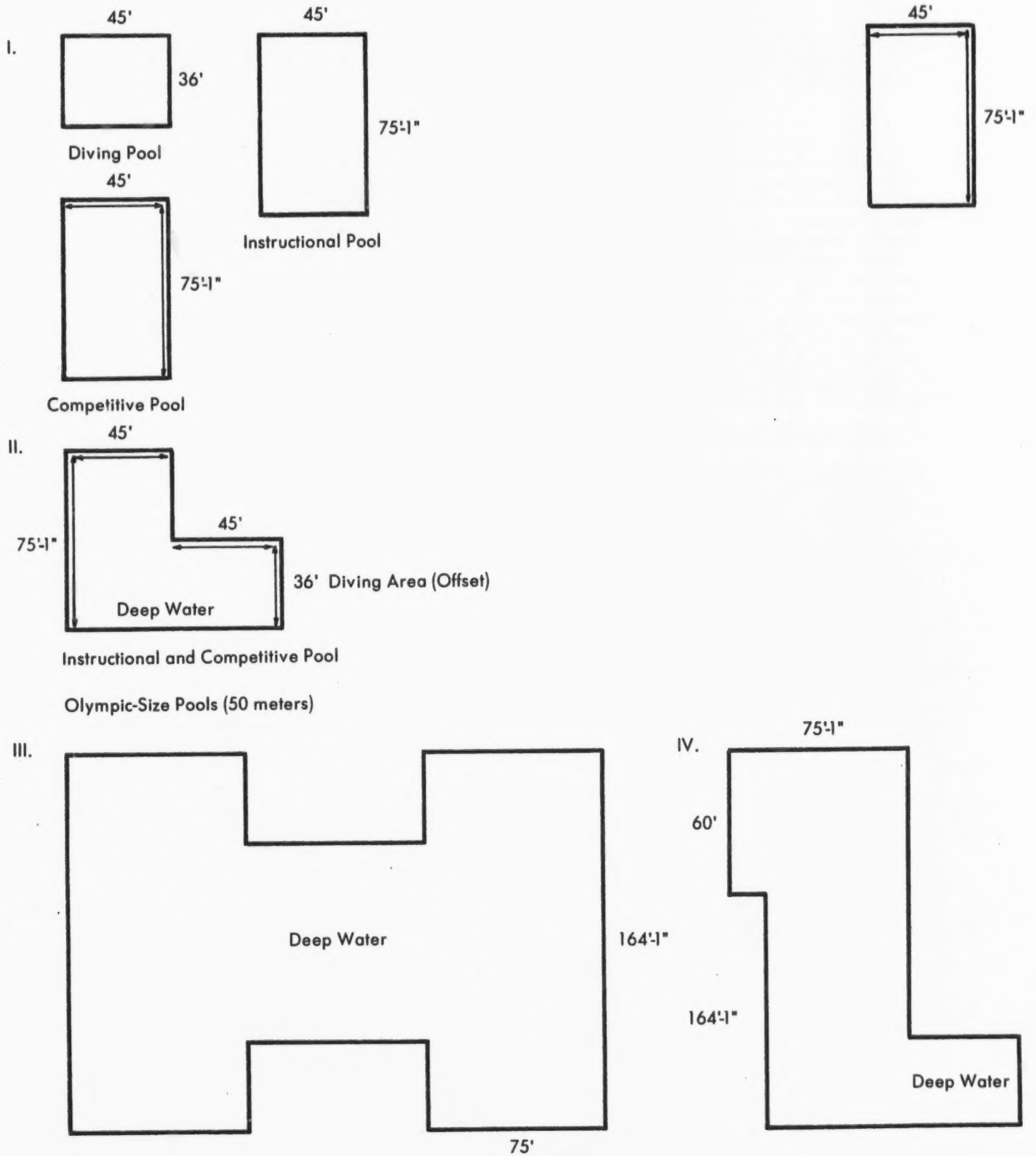


Figure 14
Suggested Arrangements for College Aquatic Units

INDOOR AND OUTDOOR SWIMMING POOLS

- Know the anticipated maximum funds available for new aquatic facilities.
- Become thoroughly familiar with the provisions of state and local codes regulating the design, construction, safety, and sanitation aspects of pools
- Submit the program to all members of the aquatic faculty and coaching staff and solicit their suggestions
- Revise the program in the light of suggestions received
- Submit the program to the architects to guide them in making preliminary drawings
- Meet with the architects to discuss alterations in the preliminary drawings (These processes are continuous until the final drawings have been approved.)
- Appoint the most knowledgeable member of the committee to check the progress of the construction with the appointed university building inspector to see that the facilities under construction and the approved drawings coincide

RESOURCE MATERIALS

Available reference materials should be consulted for up-to-date information on pool planning and construction (see references at the end of this chapter).

LOCATION RELATIONSHIPS

The indoor instructional pool should be located in the aquatic area adjacent to the diving well and competitive pool, but separated from them by a permanent wall. It should be located conveniently in terms of shower rooms, locker rooms, toilet rooms, lavatories, and classrooms (see Chapters 9 and 10).

The indoor competitive pool should be at ground level, with convenient spectator access to corridors and exits which will permit audiences to come and go without traversing the rest of the building (see Chapter 4). This pool should be adjacent to dressing rooms, toilet rooms, locker rooms, classrooms, and the instructional pool.

The indoor diving well should be in the same room as the competitive pool, but separated from it by means of a wide deck, parallel to the width of the competitive pool.

RECOMMENDED FEATURES

GENERAL RECOMMENDATIONS

- Rectangular-shaped pools
- Coved corners to facilitate vacuuming
- Acoustically-treated ceilings and walls
- Central office equipped with one-way observation window overlooking all areas
- Entrance to office from outside corridor not in general student traffic lanes (see Chapter 4)
- Recessed ladders, two on each side of each pool, three feet from end walls, three steps maximum, seven to ten inches between steps
- Drinking fountains in each area
- Self-flushing phlegm receptacles on the wall in each area
- Hot and cold water outlets in each area for scrubbers
- Nonskid deck material
- Telephone beside diving well and at one end of each pool, located five feet above deck level
- Cutoff system for hourly bell schedule when meets and shows are in progress
- Yardage markings every five yards on pool sides or decks at water edge

- Bulletin board, 10' x 20', in each pool area
- Electric clock in each area
- Underwater window, or windows, on sides of each pool, ten feet from the deep end and with the top of the window 3 1/2 feet beneath the surface of the water (a 4' x 4' window is minimum although larger installations may be desirable)
- Built-in or portable vacuum-cleaning system
- Depth markings on sides or ends of all pools
- Routing for swimmers from the locker and dressing rooms to toilets, showers, suiting area, and then to the pools
- Adequate deck space ranging from 6 to 20 feet (The area behind diving installations should be adequate for safe traffic circulation. Maximum deck space of 20 feet is desirable if construction costs permit.)
- Entire area free of obstructing posts and pillars
- Built-in spectator sections for pools which will be used for meets and water shows (see Chapter 13)
- Recessed receptacles for lane lines and floor installations, such as starting blocks and turn pennants for backstrokers

ADDITIONAL FEATURES RECOMMENDED FOR COMPETITIVE POOLS

- Size: 75'-1" x 45' minimum
- Depths: 3 1/2 to 7 feet if no diving boards are installed
3 1/2 to 12 feet if boards are installed
- Lanes seven feet wide, with 12-inch lines down the center on the bottom of each lane (Use color which contrasts with pool floor. These lines should end with a "T" of 30" x 12", five feet from each end of the pool.)
- Hand grips, flush with the end of the pool, in the center of each lane for backstroke starts
- Turn targets 30 inches square, built or painted into the end wall in the center of each lane (An abrasive material or paint is recommended. The color selected should contrast with the pool wall.)
- Adequate clear wall space for mounting scoreboards and record boards
- Large double door with flush threshold, leading to a loading area or driveway for delivery of heavy or large equipment (see Chapter 4)
- Floor or wall fixtures for pennant lines 15 feet from each end of the pool, which permit pennants to hang at regulation height for visibility by backstroke swimmers coming into their turns

ADDITIONAL FEATURES RECOMMENDED FOR INSTRUCTIONAL POOLS

- Size: 75'-1" x 45' minimum
- Depths: 3 1/2 to 12 feet if diving boards are installed
3 1/2 to 7 feet if no boards are installed
- Water-polo markings at each end of pool (consult rule book for regulations)
- Recessed receptacles for water-polo goals on ends of pool, or overhead installations which can be raised and lowered
- A large pegboard of marine plywood or plastic for pegging scenery design for water shows
- Hooks or pulley installations at or near the ceiling or one wall for handling backdrops for water shows

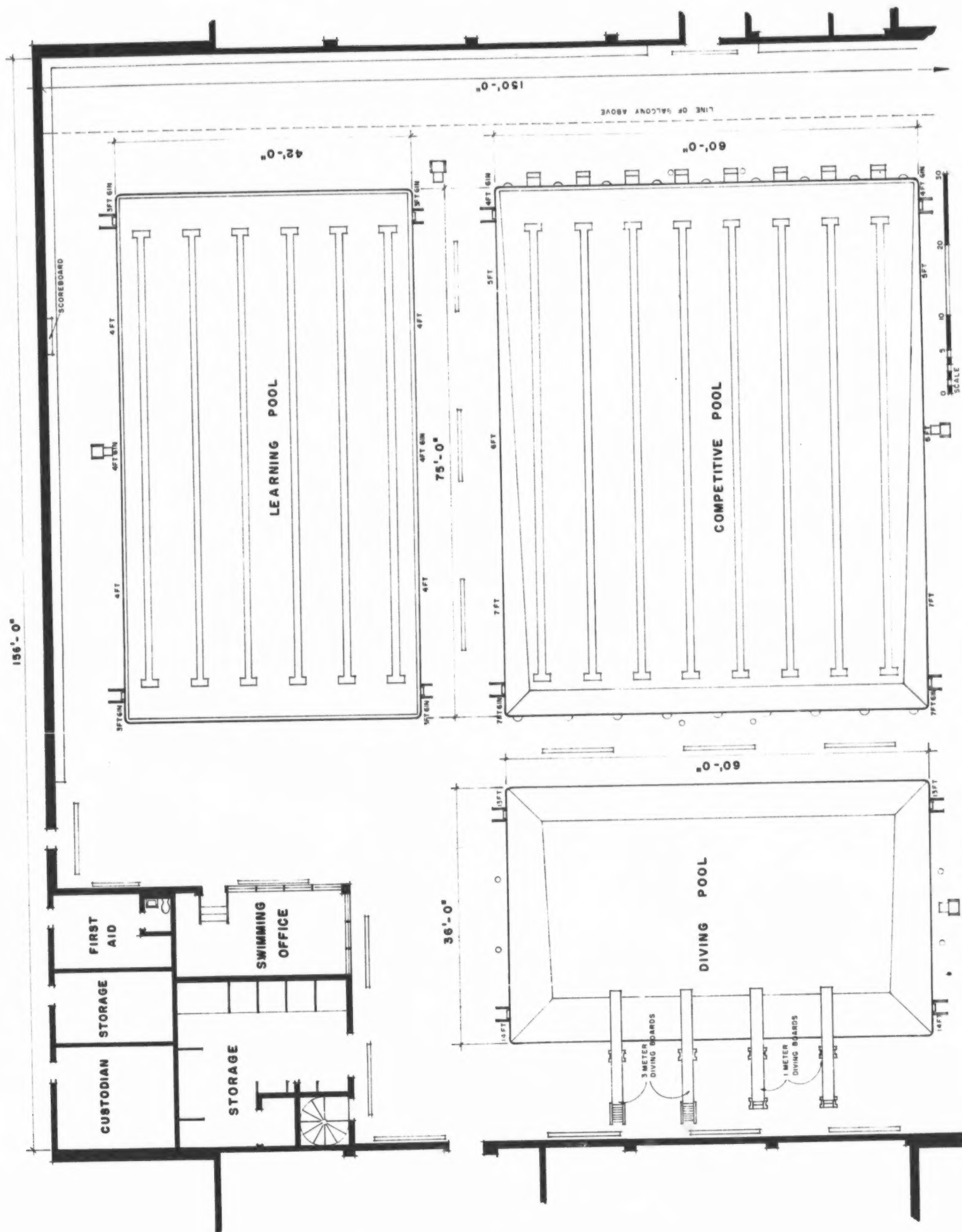


Figure 15
Brigham Young University Aquatic Complex



Figure 16
Brigham Young University Aquatic Complex

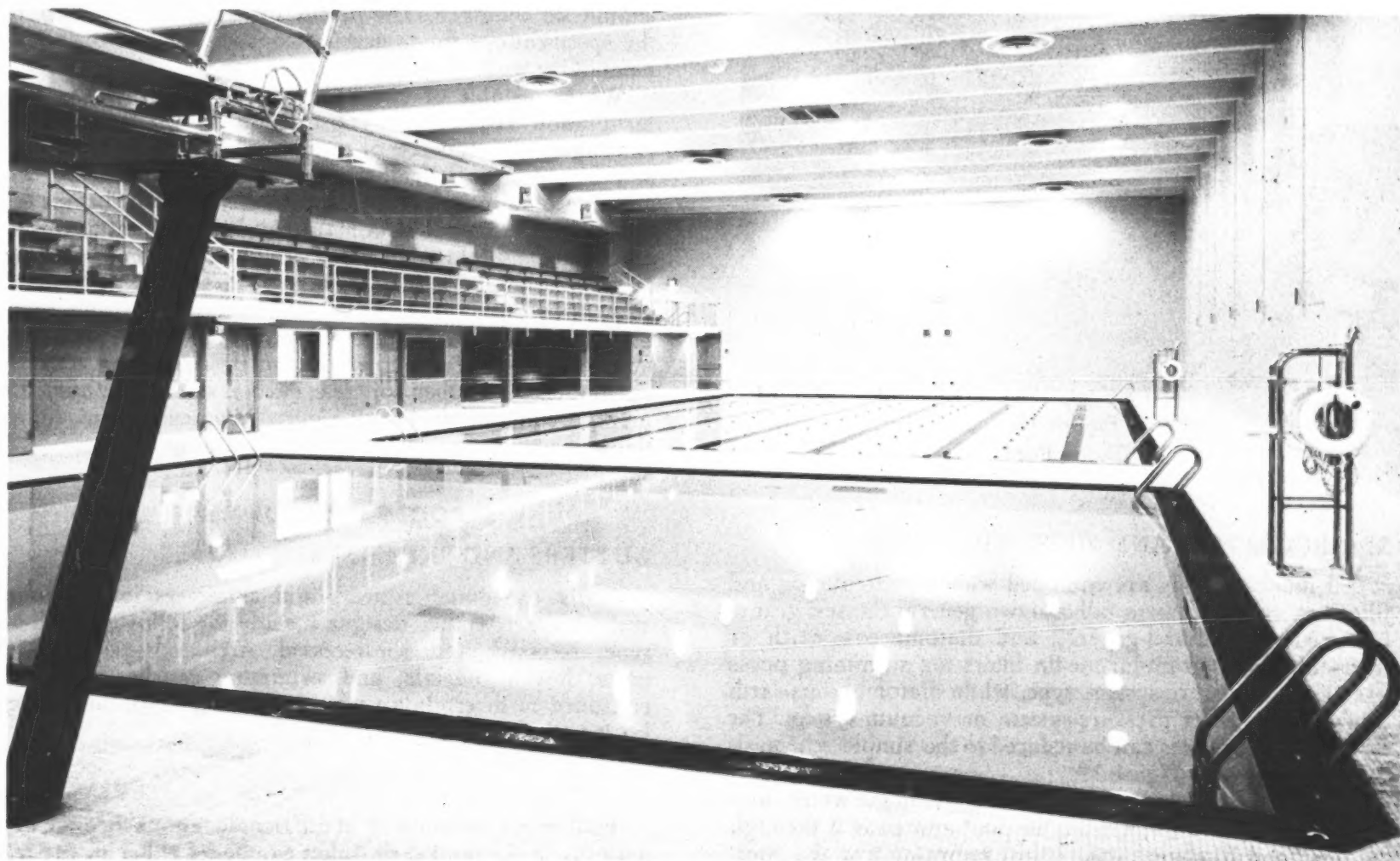


Figure 17
University of Wisconsin Aquatic Complex

ADDITIONAL FEATURES RECOMMENDED FOR DIVING POOLS

- Size: 45' x 36' minimum
- Separate from competitive pool, but in the same room
- Depth: 14 to 16 feet to accommodate three-meter boards and platforms
- Ceiling height of 15 feet above highest board, or ten feet above platform
- Water surface agitator in front of each board
- One- and three-meter boards and platforms installed to meet competitive regulations (see DGWS, NCAA, and AAU references at end of chapter. Platforms may be installed on pillars or hung from the ceiling, as illustrated in Figure 18.)
- Boards installed ten feet apart (use center of board to measure distance) along one wall, ten feet from sidewalls
- Diving-board stands, ladders, and fixtures of noncorrosive metal treated to prevent electrolysis
- Guard rails on all ladders and platforms above one meter in height
- Ladders three feet from pool ends, built into sidewalls

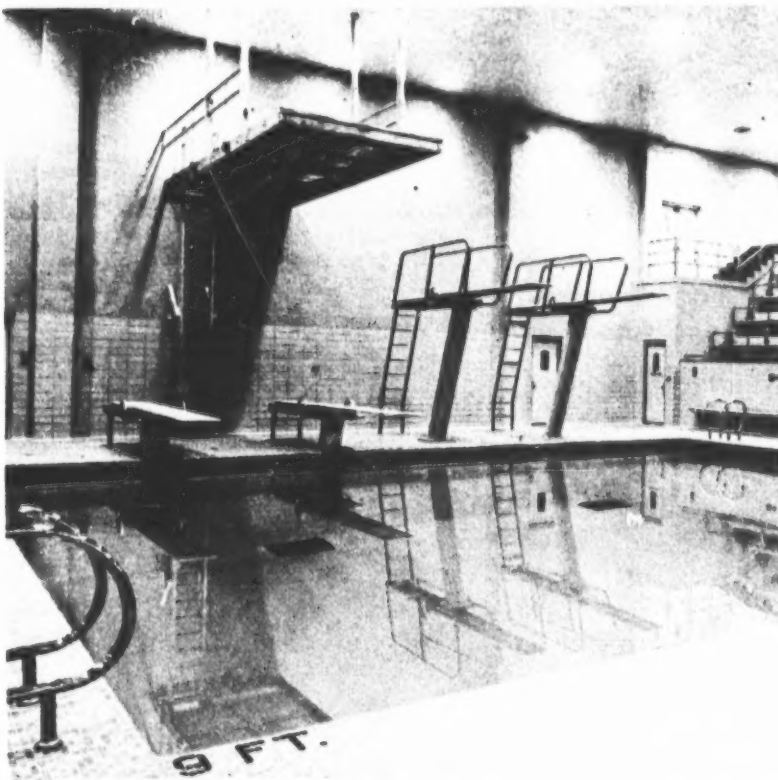


Figure 18
Diving Pool

RECIRCULATION AND FILTRATION SYSTEM

All modern pools are equipped with a recirculation and filtration system. Filters fall into two general classes: granular media (sand-and-gravel); and diatomaceous-earth or filter-aid. Most granular-media filters for swimming pools are of the pressure-system type, while diatomaceous-earth units can be either pressure-system or vacuum-system. The flow in these systems can be reduced to the simple schematic diagram shown in Figure 19.

Each system includes a pump for moving the water, and piping to take the water from the pool and pass it through the filter and treatment units before returning it to the pool. Sterilizing and water-treatment additives are usually introduced in the return piping. Local and state sanitary codes should be consulted for requirements.

In the granular-media system, water impurities are held on top of the media bed (sand, anthracite, calcite, ground blast-furnace slag, expanded shale, ground cinder, etc.). A coagulant (floc) may be used to remove extremely small particles. The system is cleaned by reversing the flow and backwashing the bed.

Diatomaceous-earth and/or filter-aid filters remove water impurities as the flow passes through a thin layer of diatomaceous earth or other filter-aid covering the filter elements. When the filter elements have become plugged with impurities and can no longer pass adequate water volume, the filter is cleaned by a backwash or by sluicing of the elements until they are entirely clean. A fresh layer (precoat) of diatomaceous earth is then placed on the elements and the filter is returned to service. During the filter cycle, the element coating is kept porous and is prevented from early plugging, i.e., "short cycles," by the continuous addition of slight amounts of diatomaceous-earth slurry, also known as "body coat."

CONSTRUCTION MATERIALS

Every pool shell is a foundation structure, with water on the inside, and sometimes on the outside too. In designing the pool shell, the particular soil mechanics must be thoroughly investigated. Borings, at least two at the shallow end and two at the deep end, provide vital reference information.

An experienced soil-investigation service should be engaged. Certified logs should show changes of stratum, spoon and casing blows at five-foot intervals, the water table, the rock-core recovery, and all irregularities of the natural formations. Expert interpretation of boring logs should be obtained. The profile of the pool will determine the specifications for materials, construction, and reinforcement of the wall.

When unstable or unsuitable conditions for ground-level installation require the construction of pools above the existing grade, concrete or metal pool shells supported on a suitable structural framework should be considered. For concrete buildings, pools using concrete support beams and integral-formed pool bottoms are usually advantageous. In an all-steel building, structural steel fabrication has advantages.

In-the-ground pools have been developed using many construction materials and techniques for the shell construction, including the following: poured reinforced concrete; pneumatically-applied concrete; carbon steel; aluminum; and brick or concrete-block wall, poured concrete bottom. All are finished with a light-colored paint or ceramic tile.

POOL-SHELL EQUIPMENT

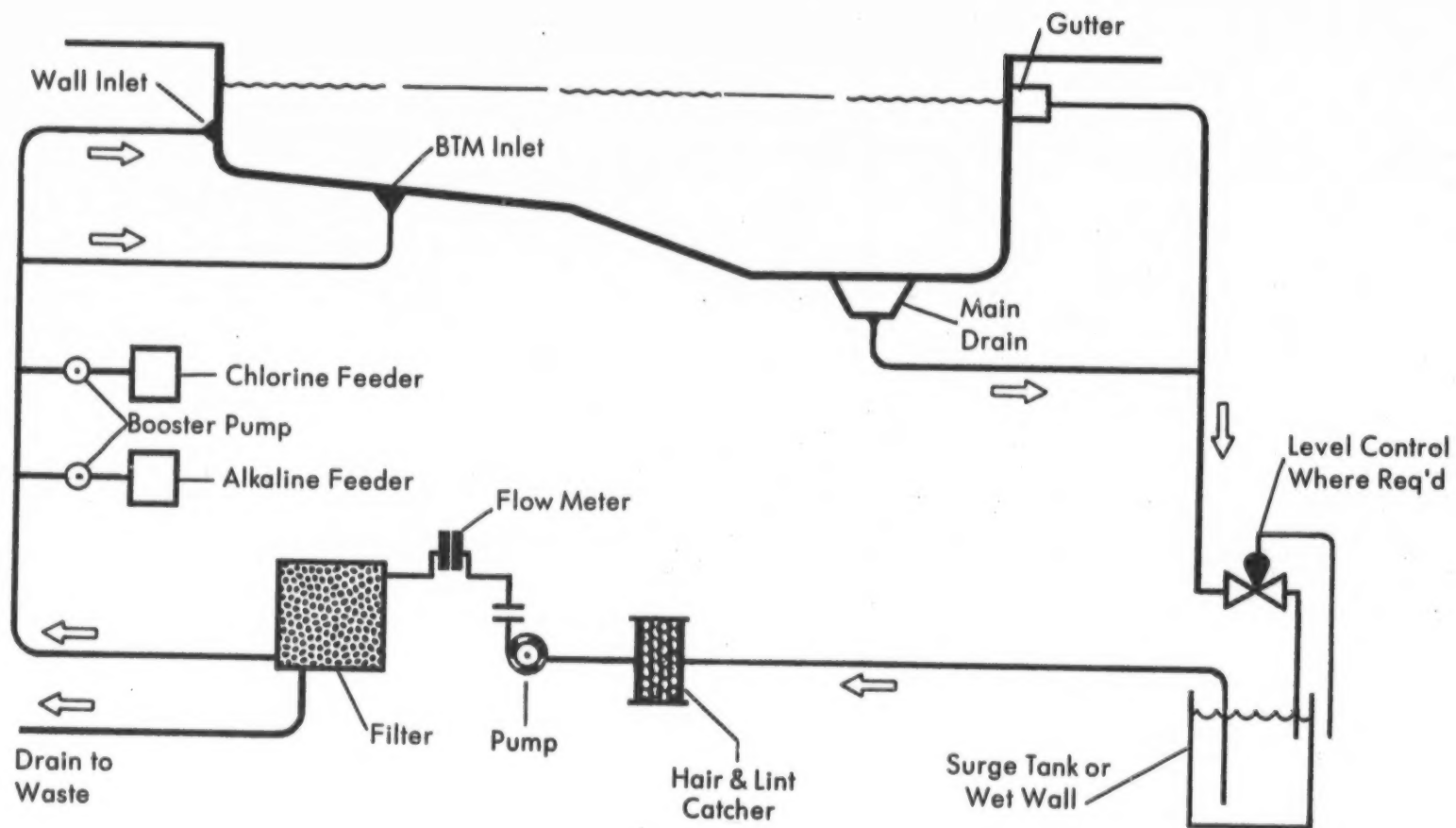
GUTTERS AND SKIMMERS

Pools use gutter systems and skimmers for removing surface water. Gutter designs include the following: roll-out type; recessed; and semirecessed. Architects, pool consultants, health officials, and swimming coaches should be consulted in determining what is best suited for the particular installation.

INLETS

Pool water is returned at different locations through connections in the pool shell. Inlets can be set either in the wall or on the pool floor. The use of floor inlets normally results in better pool hydraulics and a self-cleaning action. Local and state codes should be consulted for requirements.

Typical Pressure Filter System



Typical Vacuum-Type Diatomaceous-Earth Filter

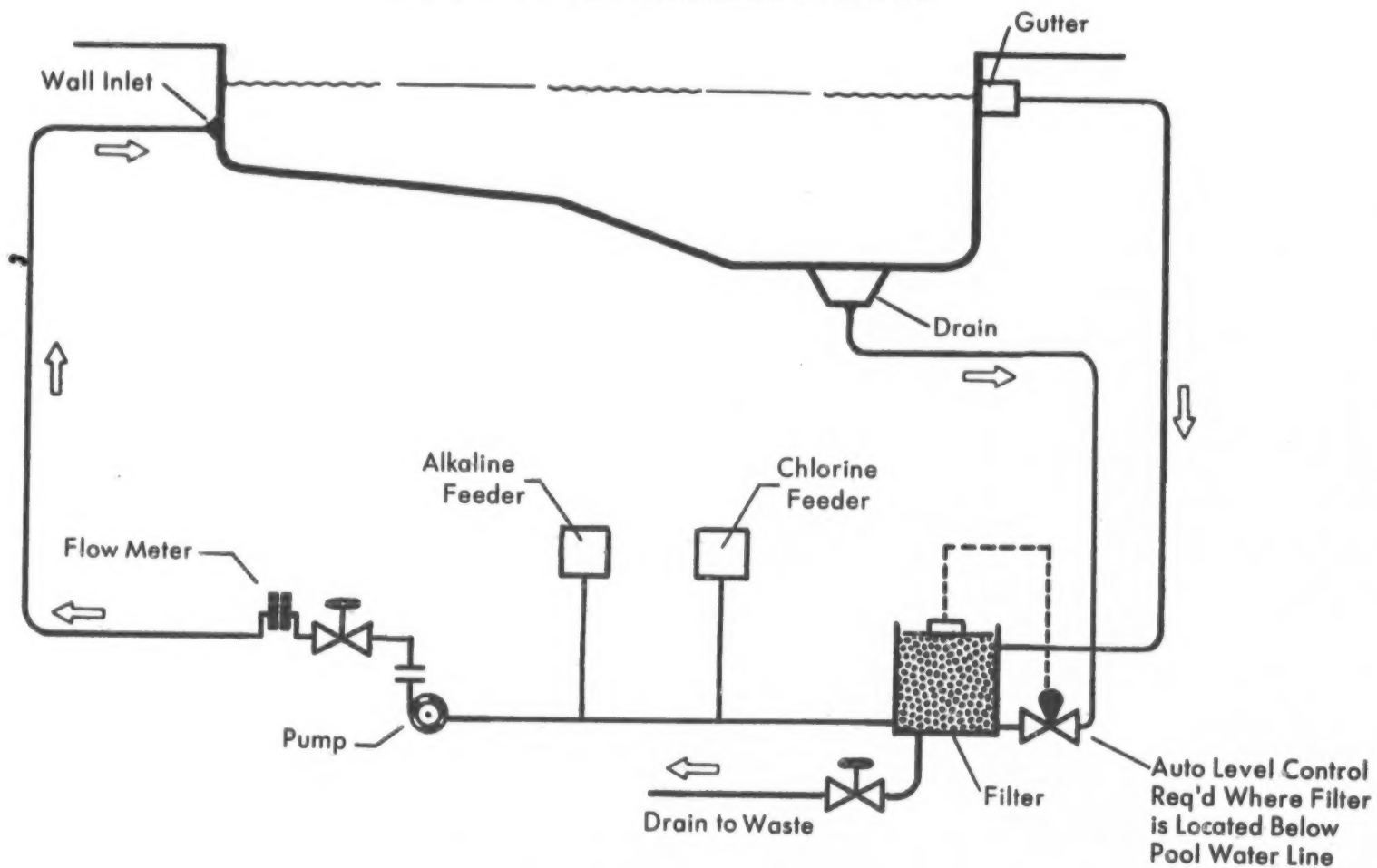
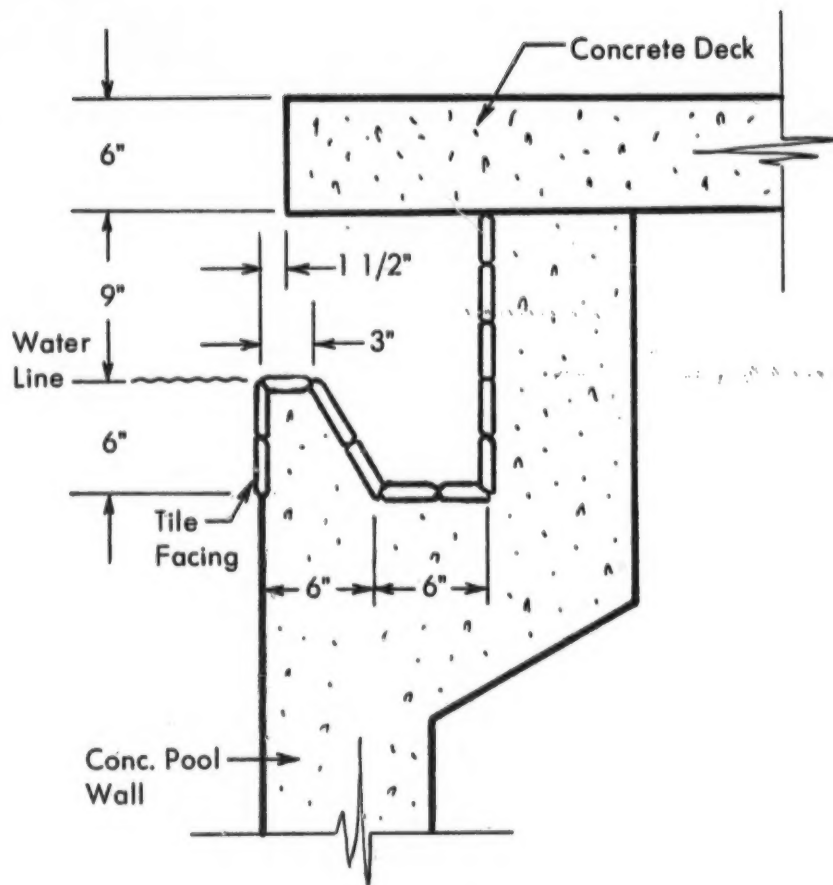
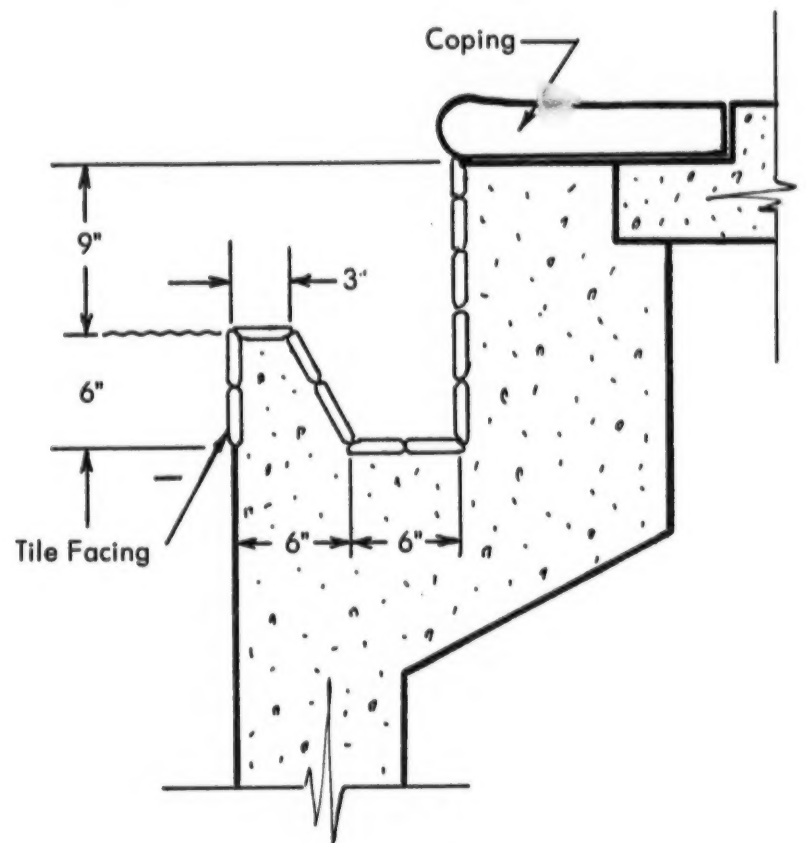


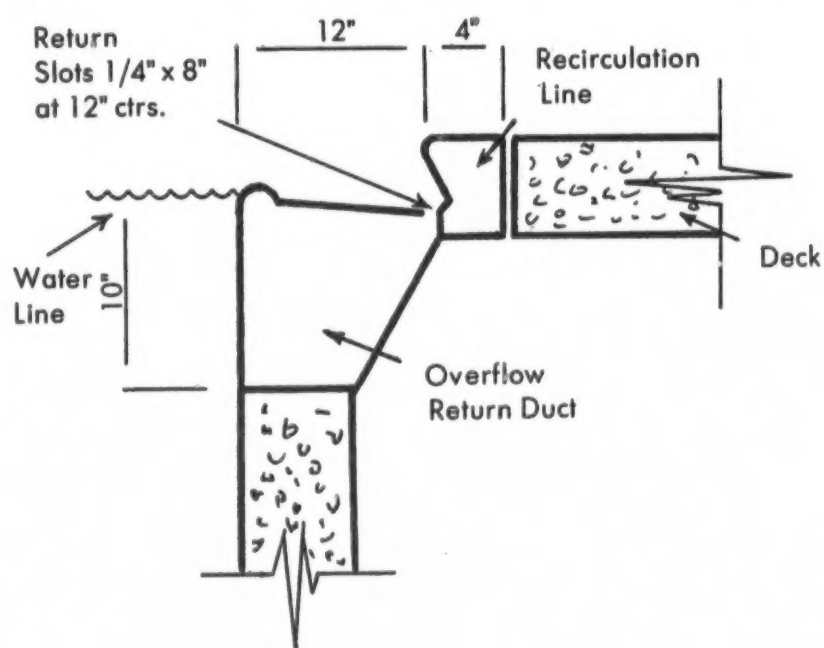
Figure 19
Swimming Pool Filter Systems



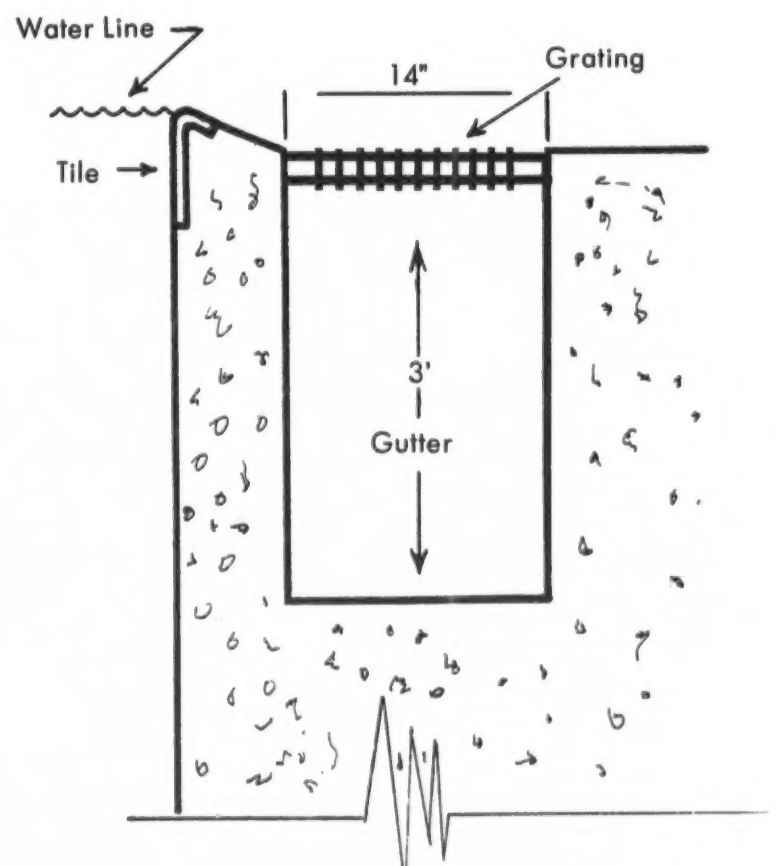
Full Recessed
Concrete &/or Metal



Semirecessed
Concrete &/or Metal



Enclosed, Roll-out Type
Metal Pool



Flush Deck
Concrete &/or Metal

Figure 20
Types of Overflow Gutters

DRAINS

Drains are devices located at the pool bottom for the collection of deep-end water, and for emptying the pool. Usually, a removable grate is set in a frame, flush with the bottom of the pool and firmly secured in place so that it cannot be removed by swimmers.

Main drains are also used as pool-water returns, similar to an inlet, and styles to accommodate these systems are available. Perforated drains are desirable for safety, and should never be located below the diving trajectory. Local codes set standards for the sizes of drains.

HYDROSTATIC RELIEF VALVES

Hydrostatic relief valves can be the most important shell equipment provided. Every pool, when empty, is essentially a boat hull. Water beneath the hull tends to cause the pool to float. Hydrostatic relief valves relieve external water pressure on the pool shell.

ALARM SYSTEMS

Alarm systems for indicating the presence of persons in the water when the pool is closed and unsupervised can perform important watchman service. Troubles with early models are being corrected and practical systems are now available.

ILLUMINATION SYSTEMS

Underwater lighting must be installed in accordance with the requirements of local authorities. This information should be obtained early in the design-program planning stage. If underwater lighting is used, it should be grounded to the cold-water system, and an authoritative electrical engineer should check the effectiveness of the installation. Water volume has a great influence on lighting levels throughout the pool shell. (See illumination tables in Chapters 4 and 5.)

Attention to the spacing of underwater light units is needed. The Illuminating Engineering Society recommendation yields good results, although what appears to be needed is a volumetric basis of calculation similar to the "zonal cavity" computations being introduced to the profession.

White lighting, containing a very light tinge of blue, has been used successfully for night lighting. For pools that are lighted at night, amber lighting has proved most effective in minimizing insect attraction. Other colors reduce the transmission of light to a serious extent and cause the swimmers to look garish. Area lighting should be designed by a lighting specialist.

Excessive source glare can be prevented by a sufficient number of fixture locations. The fixture mounting height should be at least 30 feet for uniform comfort levels and glare reduction.

Colored spotlights can be used effectively for architectural interest and for highlighting the diving tower, starting blocks, ladder locations, walls, and other areas.

Infrared heating lamps and quartzline heating fixtures, in addition to providing light, can be used effectively for projecting radiant heat to ensure extra comfort at principal activity locations.

CONTROL OF AIR CIRCULATION

In all pool areas, the plan for control of air circulation should provide for heating and cooling cycles to allow for an orderly release of heat from the body of the swimmer so that there will be no draft sensations (see Chapter 4).

ELECTRICAL OUTLETS

Multiple electrical outlets should be installed on the sides and ends of all pool areas, three to four feet above deck level. The weatherproof, outdoor type which is grounded for safety is recommended.

DECK DRAINS

In all pool areas, deck drains should slope away from the pool toward the center of the deck or outside wall. Local and state sanitary codes should be consulted for requirements.

STORAGE

A storage room should be accessible from the pool deck. This room should be constructed to meet the needs of the program, and should relate to the specific facilities. It should be equipped with double doors and flush thresholds, and should contain no obstructing pillars or inconvenient cul-de-sacs. A room with minimum dimensions of 20' x 40' will provide space to accommodate canoes and other large pieces of equipment used in the aquatic program.

LOCATION OF MECHANICAL INSTALLATIONS

Below the aquatic wing, a tunnel should lead to all plumbing which should be exposed to facilitate future repairs and maintenance. This tunnel should also permit access to the underwater windows. Separate and oversized filters, pumps, and heaters for each unit will increase the life of the installation. Separate thermostats connected to influent water pipes should be installed in each unit.

ADDITIONAL REQUIREMENTS FOR OUTDOOR POOLS

LOCATION

Outdoor pools should be conveniently located in relation to other facilities for health, physical education, and recreation. Locations in natural valleys, basins, or depressions in the terrain should be avoided. Relatively-dry subsurface conditions are recommended for outdoor-pool installations.

Locations adjacent to wooded areas, industrial plants, main traffic areas, or other possible sources of pool contamination should be avoided.

DESIGN

The same design considerations are desirable for outdoor as for indoor pools, except that larger installations are frequently constructed outdoors.

Deck space for outdoor pools should be at least twice the square footage of the surface of the water. It is recommended that consideration be given to the development of a dry deck area for sunbathers.

WINDBREAKS

The structures housing the dressing facilities, showers, office, and mechanical equipment should be located to form a windbreak for the pool area in situations where the prevailing wind may interfere with swimmer comfort. Plastic or canvas may be hung on the fence for additional windbreaks if required in a specific situation.

WATER HEATING

In temperate and colder climates, provision for heating the pool water will extend the annual period of pool use.

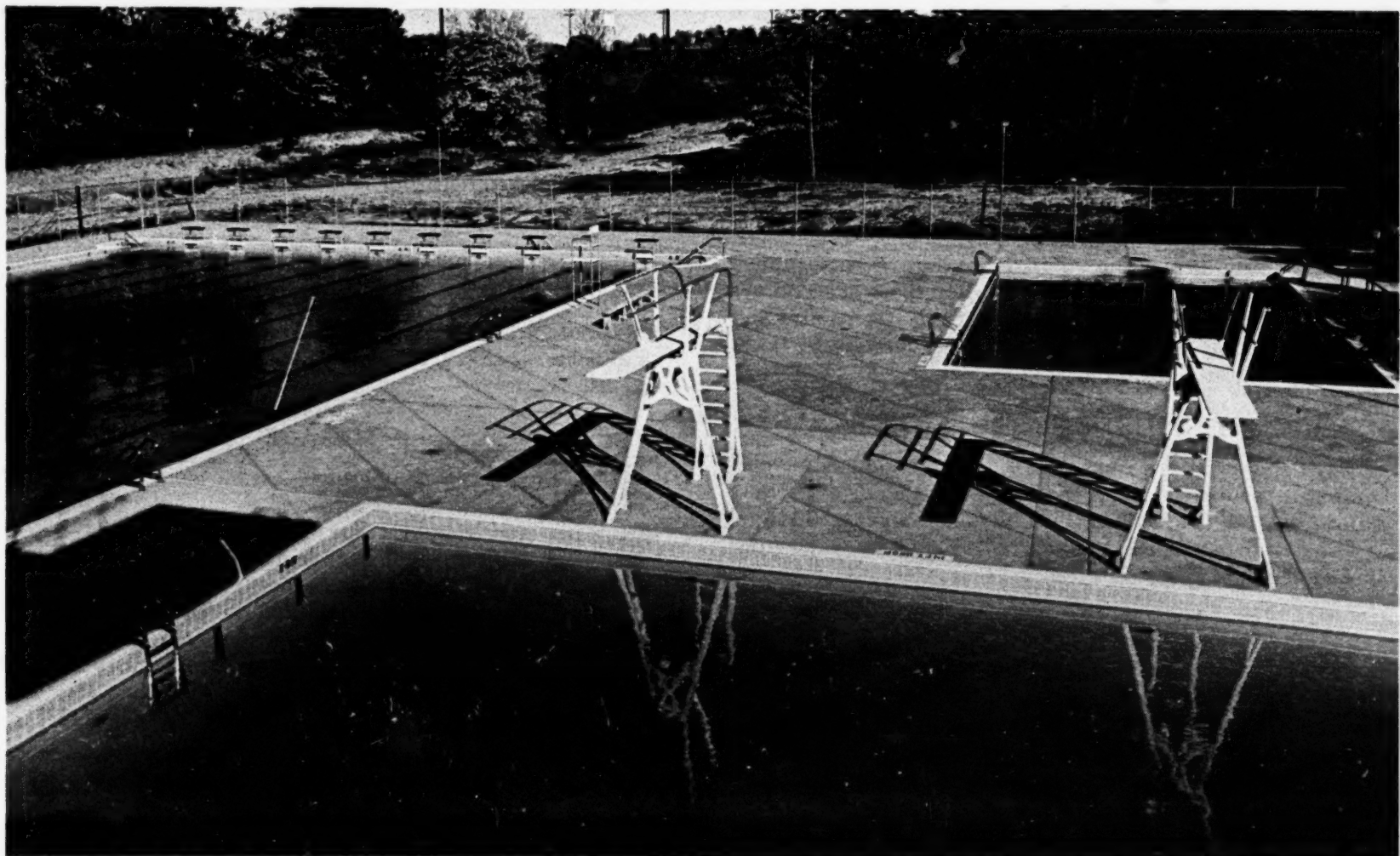


Figure 21
Outdoor Aquatic Complex, Indiana University

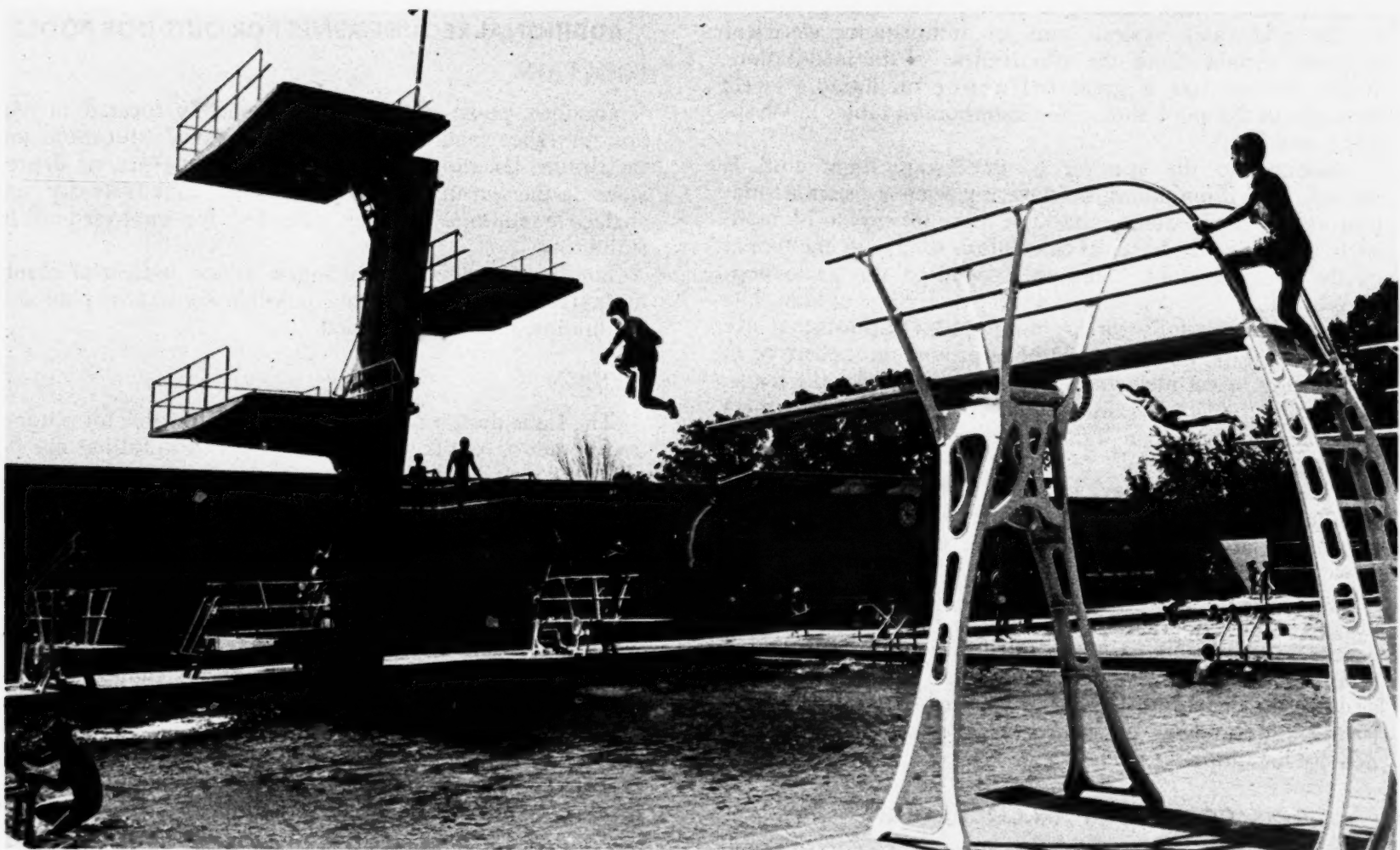


Figure 22
Outdoor Olympic Swimming Pool, Indiana University

INDOOR AND OUTDOOR SWIMMING POOLS

POOL COATING

The interior surface of the pool should be finished with a smooth coating which can be kept clean, but which also provides traction for safe walking in shallow water.

ILLUMINATION

Illumination recommendations for outdoor pools can be found by referring to the charts in Chapters 4 and 5.

FENCING

Outdoor-pool installations must be completely enclosed by a fence at least seven feet high. Local and state codes should be consulted.

DIVING FACILITIES

Diving facilities depend upon the type of outdoor installation. If at all feasible, the construction of a separate diving well is advocated. Boards and platforms should be mounted so that the diving end faces south or east. Diving platforms add to the flexibility of the facility, and their specifications should conform to official AAU and/or Olympic requirements for competition. Appropriate rule books should be consulted for details.

STEPS

Steps at the shallow end are useful in outdoor pools. They should be set back into the wall, and the treads should be of contrasting color and finished with nonskid paint or other nonslippery material. Handrails are desirable for use by disabled and older swimmers.

LANES

Competitive lanes for outdoor pools must be eight feet in width.

ENTRANCES AND EXITS

Entrances and exits, located at the shallow end of the pool, are recommended for control of traffic and ease of supervision (see Chapter 5).

MECHANICAL EQUIPMENT

Filters, pumps, and other mechanical elements for the outdoor pool must be adequately-sized to take care of the extra demands caused by contamination elements, algae, and the more rapid chlorine fade-out which occurs in the presence of sunlight.

THE OUTDOOR POOL AS PART OF A RECREATION COMPLEX

Outdoor swimming areas may be planned as part of a recreation complex. In this situation, consideration should be given to swimming facilities for children. Separate wading pools, or an increase in the shallow water areas in the regular pools may be considered.

Where the pool depth ranges between 3 1/2 and 4 feet, the shallow-water area can be increased to two-thirds of the pool length. If a wading pool is installed, the water depth should range from 8 to 24 inches, and the pool should be fenced and separately controlled for safety.

SPECTATOR SEATING

Bleacher-style spectator sections are needed when water shows and competitive meets are held in outdoor pools. Such seating may be permanent or portable, depending upon the needs of the particular institution. The stands should parallel the length of the competitive course and be placed so that spectators will have their backs to the afternoon sun.

SOUND SYSTEMS

Public-address systems, record players, and underwater speakers are desirable additions to outdoor installations. Care must be taken to place speakers and the microphone inputs strategically around the pool area. It is unsafe to extend electrical cables around pool decks in proximity to moisture.

LIFEGUARD STANDS

Large outdoor pools require careful study to determine correct placement of lifeguard stands for good visibility under peak-load conditions. Local and state codes should be consulted for safety regulations.

SELECTED REFERENCES

Aquatics Guide. Washington, D.C.: Division for Girls' and Women's Sports, American Association for Health, Physical Education, and Recreation (NEA) 1963-1965.

Council for National Cooperation in Aquatics - Conference Reports. Washington, D.C.: The Council, 1201 Sixteenth Street, N.W., 20036.

Kahms, Frederick W., Jr., A Summary of Selected Features of the Indoor Swimming Pool. Lafayette, Ind.: Purdue University.

Kaufman, John E., ed., I.E.S. Lighting Handbook. New York: Illuminating Engineering Society, 345 East 47th Street, 4th ed., 1966.

Means, Louis, and Gibson, Charles, Planning School-Community Swimming Pools. Sacramento: California State Department of Education, 1955.

Meslin, Jerry, ed., Florida Swimming Pool Operator's Text. Miami, Fla.: The author, 301 N.W. Court.

National Collegiate Athletic Association Swimming Guide. New York: The National Collegiate Athletic Bureau, 1966.

Official Swimming Handbook of the Amateur Athletic Union of the United States. New York: The Amateur Athletic Union of the United States, 1966.

Recommended Practice for Design, Equipment, and Operation of Swimming Pools and Other Public Bathing Places. New York: American Public Health Association and The Conference of State Sanitary Engineers.

Swimming Pool Age Magazine. Fort Lauderdale, Fla.: Hoffman Publishers.

Swimming Pool Data and Reference Annual. Fort Lauderdale, Fla.: Hoffman Publishers, 1964.

Swimming Pool Operation. Springfield, Ill.: Department of Public Health, Circular 822.

Swimming Pools: Disease Control Through Proper Design and Operation. Washington, D.C.: United States Government Printing Office.

Chapter 8

OUTDOOR ACTIVITY AREAS

A basic principle throughout this **Guide** is that the program should determine the facilities required. Therefore, the facilities needed for outdoor activities will depend upon the nature and extent of these activities. The activities, in turn, will depend upon program purposes and upon the interests, needs, and abilities of the participants.

GENERAL FEATURES OF OUTDOOR FIELDS AND COURT AREAS¹

SITE SELECTION

In selecting a site for the location of turf playing fields, a level rectangular area with a ratio of 3 to 5, width to length, is recommended. However, the shape of a site is far less important than the size or possibilities for future expansion.

The potential for field development is an important consideration in the location of a site. However, in many situations, little choice is offered. Fields must be developed on existing areas or not at all. If possible, however, consideration should be given to the surrounding environment as it relates to buildings, highways, parking areas, walks, prevailing winds, drainage, and accessibility to existing locker and shower rooms.

The location of outdoor facilities in relation to each other, to indoor areas and associated buildings, and to the people who will use them is important in evaluating their long-term usefulness in the program for which they are designed. Listed below are a number of important factors which merit careful consideration in selecting a site.²

ACCESSIBILITY

The site selected for the development of physical education and athletic fields should be easily accessible to the individuals who will be their principal users.

ISOLATION

Outdoor physical education and athletic facilities should be isolated from persistent and unnecessary distractions. Conversely, these facilities should also be so located that their use does not become a distraction for nearby classrooms and living units.

INTEGRATION

Outdoor facilities should be located strategically in relation to one another and to other accommodating facilities.

ADAPTABILITY

A site for outdoor facilities should combine qualities of permanence with those of flexibility. These facilities should be located and designed in such a way as to permit ease and economy in bringing about the alterations and changes that future requirements may demand.

EXPANSIBILITY

Plans for long-term efficient use of field areas should anticipate the possibility of changes in emphases in the program through the years. In planning for these eventualities, it is necessary to locate field and court areas on sites which are somewhat larger than minimum requirements demand. It is also important that goal and net posts, backstops, and other fixtures be planned in such a way as to permit rearrangement when necessary. In addition, attention should be given to the effective utilization of all opportunities for the multipurpose use of facilities.

SITE DEVELOPMENT

Problems which are commonly present in site-development projects are concerned with grading, drainage, landscape design, fencing, and accessibility to water and electricity.

GRADING

Outdoor physical education and sports activities are best promoted on field and court areas that are relatively level. However, the topography of available sites and the cost of filling and cutting often make some terracing necessary. When this is the situation, the following factors should be considered:

- **The multiple use of the area.** If the area is to be used for different activities during different seasons of the year, the total area required for these activities should be superimposed on the topographical map of the site, and terracing should be planned in such a way that the needed space is provided.
- **The orientation of activity areas.** Generally speaking, all outdoor game fields and courts should be oriented lengthwise in a north-south direction. A 45-degree deviation, however, is permissible.

DRAINAGE

It is always necessary to provide for a gradual slope of all field and court sites to assure the efficient removal of excess surface water. A one-percent slope is recommended as maximum for turf areas. For a stadium football field, a 12-inch crown down the longitudinal axis on the middle of the field is recommended.

For baseball, the pitcher's box should be elevated 15 inches above the base lines and home plate. The slope from the pitcher's box to home plate and to all base lines should be gradual. A one-percent drainage grade for the outfield

¹ See Chapter 5 for additional information.

² James B. Delamater, *The Design of Outdoor Physical Education Facilities for Colleges and Schools*, Bureau of Publications, Teachers College, Columbia University, 1963, pp. 26-27.

OUTDOOR ACTIVITY AREAS

is recommended.

Large hard-surface multipurpose areas are generally sloped so that surface water is directed toward specific collection points. It is recommended that for tennis, volleyball, badminton, and other net games the slope be from one side to the other.

Attention should be given to the problem of subsurface drainage in the development of playing fields. This problem is generally peculiar to the existing conditions, and consultation with a competent landscape engineer is recommended. Due to the hazards of damage from freezing, subsurface drainage is also an important consideration in the development and construction of hard-surface court areas.

LANDSCAPE DESIGN

The primary objectives to be realized in designing field areas for physical education and sports activities are those that are concerned with their functional aspects for the activities to be served. However, these functional aspects can be enhanced when the landscaping requirements are met in such a manner that the areas are attractive and combine beauty with function.

Landscaping should be planned so as to improve the playing conditions of the activities for which the playing surfaces are designed. Shrubs, hedges, trees, and vines can be used as windbreaks, background barriers, spectator screens, and ground cover. They also enhance the value of adjacent property and provide a better environment for the enjoyment of the activity.

An important duty of the landscape engineer is to provide proper and well-designed entrance and exit walks, drives, and parking areas for all playing areas.

WATER AND ELECTRICITY

No turf playing area can be properly developed or maintained without an adequate supply of water. Therefore, in designing a field area, it is recommended that an automatic sprinkler system be installed that will require a minimum of maintenance.

Electrical outlets should be available at all field and court areas. The number, size, and voltage should be determined by the requirements of needed field lights, public-address systems, concession facilities, scoreboards, and maintenance equipment.

Consideration should always be given to the possible location of a telephone at all field and court areas. This is a safety precaution for emergencies, an aid and important time-saver for maintenance help, and a convenience for players and spectators.

FENCING

Fencing is a requirement for many physical education and sports areas. It is needed for security, safety, separation, and traffic control. In the case of baseball, field hockey, softball, soccer, rugby, lacrosse, and tennis, fences are used to confine the ball to the playing area, and thus enhance the play of the game and the enjoyment of spectators. Unfenced baseball and softball fields reduce the home-run potential.

In lacrosse, field hockey, soccer, and rugby, a fence three feet beyond the end line of the playing field confines most out-of-bounds balls and reduces time lost in retrieving the ball. A ten- to twelve-foot fence around all sides of tennis courts is recommended to confine the balls and speed up play.

LIGHTING

The lighting of playing fields and court areas is a necessary consideration in most college situations in order to provide maximum use of these facilities for a rapidly-increasing number of users. The lighting of such facilities, in many locations, also makes it possible for participants to use the facilities when time and climatic conditions are most suitable.

Sports lighting involves many special types of problems. These problems can only be solved by consultation with competent lighting experts. Private consultant firms, local utility companies, and manufacturers of lighting equipment are available in all sections of the country and are ready and willing to offer assistance.

The levels of illumination currently recommended for outdoor sports areas are shown in Table 5.

SERVICE FACILITIES

In order to facilitate the proper organization, administration, and supervision of the outdoor physical education and sports activity programs, facilities for the dispensing and storage of playing equipment should be on or readily accessible to the site. These facilities should include space for equipment needed in the maintenance of the area, and for benches, tables and chairs, and rest rooms for men and women spectators.

Plans for such areas should include consideration of the accessibility of dressing and shower facilities for home and visiting teams, game officials, and coaches. In many situations, it has been found more economical to provide transportation to and from the playing site than to construct these facilities.

AREAS FOR FIELD ACTIVITIES

All field and court dimensions in this chapter are subject to change by the official rules committees which govern the particular activity. Current and official sources of rules for each activity must be suited to assure updating such changes as they occur. These sources are included in the selected references listed at the end of the chapter.

ARCHERY TARGET RANGE

Space:	135' x 300' (8 targets)
Dimensions:	15 feet between targets -- center to center
Markings:	Shooting lines for specified distances of rounds (20-40-60 yds.) drawn parallel to target line
Safety Areas:	30 feet each side of range (minimum) 75 feet behind targets (minimum)
Surface:	Turf range - level and free of stones and surface obstructions Buffer area back of targets level and free of obstructions
Other Functional Requirements:	Tackle house - storage of targets, target stands, ground quivers, arrow rests, marking equipment
Backstops:	Earth bunker for permanent range--turfed Roped-off area (back area and sides) or storm fencing for temporary range
Fencing:	Permanent fencing - shrubs desirable for entire area to control cross-traffic and provide safety factor

Lighting: Desirable for night use
Electrical connections for auxiliary lighting and public-address system for competitive events and tournaments

CORKBALL

Game Type: Baseball - 5 players per team
Space: Caged space - 20' x 75'
Open space - home-run line approximately 200 to 250 feet from home plate
Surface: Level turf or asphalt area

CRICKET

Game Type: Team sport utilizing a bat, or racquet, and bases - 22 people participating
Space: Multipurpose field 500' x 450' or 550' x 520'
Surface: Close-cropped turf
Orientation: Play should be north and south

FIELD HANDBALL

Field handball is a popular international sport played somewhat like basketball, with a ball somewhat smaller than a volleyball and approximately the weight of a soccer ball.

Space: The field of play is 65'-7" (20 meters) by 131'-2" (40 meters)
Safety: Safety lanes 30 feet between fields and at the ends are needed, and fences or some other means of confining the ball are helpful
Other Functional Requirements: The goal is 6'-7" high (2 meters) by 9'-10" wide (3 meters)

FIELD HOCKEY

Space: 2 to 3 fields - instruction, practice, competition
170' to 200' by 310' to 340' level turf area
Dimensions: 150' to 180' by 270' to 300'
Field Markings: Center line - midway between and parallel to goal lines
25-yd. lines - 75 feet from and parallel to goal lines
Women—5-yd. lines - broken line parallel to and 15 feet inside sidelines
Men—7-yd. lines - broken line parallel to and 21 feet inside sidelines
Striking circles (2)
Straight line extending 12 feet parallel to goal, connected with goal line by quarter circles with goal posts as centers
Women—12-foot line parallel with goal line - 45 feet from goal line centered on goal
Men—12-foot line parallel with goal line - 48 feet from goal line centered on goal

Other Functional Requirements: Permanent sleeves for setting goal posts to permit removal in multipurpose fields
Restrict field areas to field sports such as soccer and speedball to safeguard against

injury from base paths, worn or bare turf, and holes or irregularities
Goals: Posts - 2" x 3" - 7 feet high
Crossbar - 12 feet long
Goal Cage-Frame: Posts - 7 feet high with 12 feet between posts - 4 to 6 feet behind goals
Goal Net: Official net attached between goal and frame to form cage
Backstop: Low fencing - 3 to 4 feet high (storm or permanent fencing) 18 to 20 feet behind goal line to serve as rebound for goal shots and contain hard ball; protect other field areas and spectators

FLICKERBALL

Space: 220' x 120' close-cropped turf area
Dimensions: 160' x 90'
Other Functional Requirements:
Goals: Located at each end of the field 15 feet outside the end lines
Safety Lines: 15 feet lengthwise; 15 feet widthwise

FOOTBALL (Men)

Eleven-Man: Eleven-man football is played on a field 360' x 160', and minimum safety zones 30 feet wide on the sides and 20 feet wide on the ends are necessary.
Six-Man: Six-man football requires a field-of-play area 300' x 120', and safety zones as specified above are required.
Touch-Flag: Touch and flag football are played on fields of varying sizes and internal markings. The National College Touch Football rules specify a field 300' by 160', but much smaller areas may be used for many flag and touch football leagues. The minimum safety areas recommended for 11-man football are equally applicable for most modifications.

GOLF (On-Campus Instructional and Recreational Areas)

The advantages of specially-designed instructional areas for golf, associated with the physical education facilities on campus, merit incorporation of these areas in plans for the construction of outdoor facilities. Among the advantages of such facilities are:

- Accessibility and availability for classes, practice, and recreational use
- Elimination of the necessity to allow extra class time to reach off-campus facilities
- Free or minimal cost for recreational use by students and faculty
- Efficient use of marginal land areas, restricted plots of ground unusable for fields, or land requiring extensive fill or development for other use

DRIVING RANGE

Space: 6 to 12 acres (based on 35-tee site)—350' x 480' to 600' - varying width and topography - turf
10-foot minimum space between tees
Layout in crescent or shallow-arch shape aimed toward central point 480 feet from center tee
Safety: 10-foot restraining line (minimum distance) back of tees and at end tees

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Other Functional

Requirements: Brush, rubber link, or all-weather synthetic fiber mats set flush with turf
Low wooden-rail fencing with bag rests at rear of tees
Water supply; lighting for night use; distance signs showing yardage

COMBINED RANGE AND GREENS

One or more target greens may be incorporated in the driving-range area:

- 1 green: 360 to 525 feet from tee area
- 3 greens: ranging from 300 to 750 feet from tee area

SIMULATED GOLF FACILITY

Space: Fringe or marginal areas around athletic fields, combined with field area
Temporary, semipermanent, or permanent layout

DRIVING CAGES

Installation of driving cages for instructional use should be considered. The following advantages are evident:

- Class in compact area, which increases opportunity for individualized instruction
- Efficient use of time and space
- Elimination of necessity for recovering balls from range
- Opportunities for multipurpose use for instruction and self-directed practice

Space: 12' x 20' x 10' high per cage unit
Units may be installed in single or double rows supported by permanently installed posts and frame. Demountable units may be both advisable and practical in some areas.

Safety: 10-foot (minimum) restraining lines should be placed behind all tees. All posts should be padded to reduce hazards from rebounding balls.

Other Functional

Requirements: Rubber link, brush, or synthetic mats should be installed flush with the turf or other surface of the cage.
Drinking fountains; club racks; fixed ball racks; lighting for night use.

PRACTICE GREENS

Space: Variable, depending on anticipated volume of use, number and size of adjacent greens, and space available

For class use and practice, two or three smaller greens are preferable to one large multipurpose green.

One multipurpose practice green. Construct the green in an area permitting short approach shots from several angles. The size should accommodate 18 cups, with adequate space for periodic relocation to reduce excessive wear.

Two practice greens. Construction of two adjacent greens increases the amount of practice for each student. The location should provide space for approach shots toward each green simultaneously from back-to-back positions without undue hazard. Each green should be large enough to accommodate a minimum of nine cups for putting practice and relocation.

Three practice greens (two small and one large). Two greens should be constructed primarily for approach shots and sand-trap practice. The third green should be

constructed to serve primarily for putting practice and should be large enough to provide for installation and relocation of 18 cups.

SAND TRAPS

Dimensions: Variable—Shallow sand traps are more economical and practical for instruction and practice than are those of standard depth, requiring less maintenance and sand replacement.

Location: On diagonally-opposite sides of a single green; on side nearest adjacent green and at same general point of each green to permit greatest simultaneous use with fewest hazards; traps constructed for practice purposes may be located in any area near greens, driving range, or cages which provides a natural site with minimum preparation. Traps should be located to avoid hazard to cross-traffic or adjacent activity areas or buildings.

PAR 3 - PITCH-AND-PUTT COURSE

Space: Nine holes - 5 to 6 acres; eighteen holes - 9 to 10 acres

Specifications: All holes are 3-par holes—layout and greens to provide various combinations of short-shot requirements found on a regulation course

Other Functional

Requirements: Water for greens, fairway turf, and drinking fountains
Benches, club rests, and restraining lines for tee areas
Night lighting; combined club room, rest rooms, and storage house for maintenance equipment, tee markers, light controls, and service facilities

LACROSSE

Space: Men-field dimensions 210' x 330'
Women-no definite requirement - recommended dimensions 210' x 330'
Total area desirable 250' x 360'

Surface: Level turf field

Safety Area: 30 feet outside of boundary lines

Other Functional

Requirements: Goals of 6' x 6' (men and women) - pipe construction - portable
Desirable to have four-foot fence around total area—recommended to have four-foot fence 3 feet from each end line
Goal nets are pegged to ground 6 feet behind goal for men - 7 feet behind goal for women
Locate fields away from buildings, highways, parking lots and other game areas; provide benches, chairs, scoring tables for games; recommended that women use crosses designed for women

RUGBY (Men)

Space: Field dimensions 225' x 330' - total area 255' x 360'

Surface: Level turf area

Safety Area: 30 feet beyond field boundaries

Orientation: Generally north-south

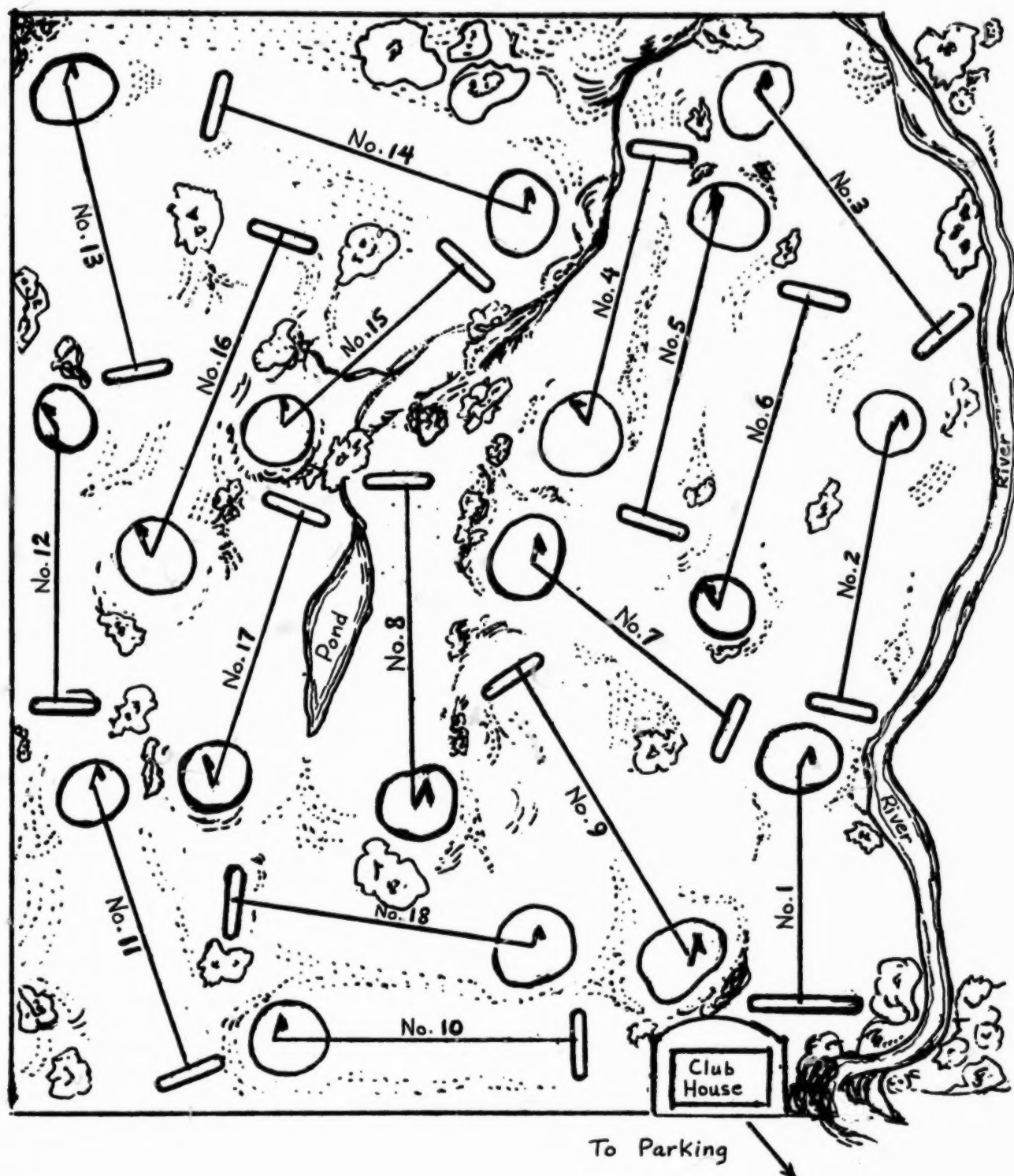


Figure 23
Layout of Par 3 Pitch-and-Putt Course

Other Functional Requirements:

Goal posts similar to football - wood or pipe - uprights 18'-6" apart, 21 feet high - crossbar 10 feet from ground
Goal posts should be padded to a height of 5 feet
Benches for players; chairs and scoring tables for scorers

SOCCKER

Space:

Women-field dimensions 120' to 180' wide by 240' to 300' long
Men-field dimensions 165' to 225' wide by 300' to 360' long

Safety:

Location:

A minimum safety area of 30 feet is needed at each side, each end, and between fields.

Because the soccer ball is frequently propelled out of the field of play, it is unwise to locate this facility adjacent to a body of water, a busy street, or a gulch. The accessibility of an earthen embankment, fence, or other means of reducing ball chasing would be a valuable feature.

Other Functional Requirements:

Goal posts are 8 feet high with 24 feet between posts (these are inside dimensions). Goal nets must be attached to the posts

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(screw hooks) and supported out behind the field of play. Materials used in the construction of the posts and net supports must be sturdy and durable. It is recommended that the post uprights be of 4" x 4" wood and that two 2" x 6" planks be bolted together (with the 6" side facing the field of play) and to the uprights. The three net supports should be constructed of 1-1/2-inch to 2-inch O.D. pipe, bolted to the crossbar, and anchored to the ground. These should be painted white.

A wooden rebound wall (or rebound net) similar to that used for tennis-stroke practice is a valuable practice facility. This facility is usually 24' by 8' (goal size).

SOFTBALL

- Space:** 275' x 275' level turf area
200- to 250-foot radius from home plate
25-foot clear, unobstructed area between home plate and backstop
Unobstructed area 25 feet wide outside foul lines
- Orientation:** Home plate, second base, and center field aligned north and south, with home plate at north end
- Other Functional Requirements:** Portable benches
Accessibility to water and electricity
See official rule books (men's and women's) for official distances between home plate and pitcher's plate, between bases, and specifications for dimensions and installation of home plate

SPEEDBALL

- Space:** 180' x 300' unobstructed, level turf area
- Dimensions:** See official rule book
Halfway line - midpoint of field and parallel to goal line
2 restraining lines - 15 feet from and parallel to the halfway line
2 five-yard lines - 15 feet from and parallel to goal lines
2 penalty areas - 15 feet from and parallel to goal lines
2 penalty-kick marks
- Other Functional Requirements:** Goal posts 18 feet apart, 20 feet high—set in permanently, or in sleeves for easy removal
Crossbar 8 feet from ground, flush with inside of posts

BICYCLING

Problems of campus transportation, vehicular traffic, parking, and even smog control all point to the desirability of the re-emergence of the bicycle in the college or university setting. Factors to encourage and accommodate this wholesome and desirable vehicle of transportation and physical recreation include paths, parking stands, and regulations for use. While solutions will be dependent on local conditions and desires, some suggestions are included below.

Safety:

To alleviate and safeguard pedestrian traffic on many campuses, internal streets have been closed to normal automotive traffic and reserved for walkers and bicyclers.

Paths:

The European-type bicycle path makes possible relatively safe and frequently picturesque routes for the cyclist.

Parking:

Bicycle racks should be provided and be strategically located to provide control as to where the bicycle is parked when not in use. These racks should be designed for economy of space and should provide a simple means of locking the bike for security reasons.

Regulations:

Regulations for registration and use of the bicycle are essential and must be developed and enforced.

CROSS-COUNTRY RUNNING

Space:

The length of a cross-country run for colleges and universities is three to seven miles. The length of the National Collegiate Championship Run is six miles.

Course Markings:

The course must be properly measured and marked by one or more of the following methods, in order of preference:

1. "Tall sign posts with large directional arrows on boards fastened to the tops so that the arrows will be plainly visible at a distance (e.g., 20 to 30 yards) to contestants approaching the posts. These posts shall be placed at every point where the course turns, and also be placed wherever there is any doubt as to the direction of travel.
2. "A lime line laid on the ground along the entire distance of the route to be traveled by the contestants.
3. "The course may be marked by flags as follows:
 - "A red flag to indicate a turn to the left.
 - "A yellow flag to indicate a turn to the right.
 - "A blue flag to indicate the course is straight ahead.
 - "The flag(s) shall mark the shortest perimeter of the course."³

OBSTACLE COURSES

Description:

Obstacle (challenge) courses in many forms are providing vigorous and challenging activity in numerous instructional and personal-development programs throughout the nation. These courses include running paths of varying lengths and terrain, and a variety of obstacles.

Apparatus:

Such courses include: walls for scaling; ropes, poles, and pegboards for climbing; hurdles and pits for jumping and leaping; overhead bars, ladders, and ropes for hand, arm, and shoulder-girdle development; platforms, bars, and other structures to be crawled through or under; mazes (posts which outline a zig-zag path for agility running); and other types of obstacles which present tests of speed, agility, strength, endurance, and even in some instances, courage.

Design:

At the present time, these courses are designed and constructed locally and are dependent on the ingenuity of the physical educator and the availability of the space, materials, and technical assistance needed to construct the obstacles. It may be that the future will see standardization in

³ National Collegiate Athletic Association, Track and Field Guide, College Athletics Publishing Service, Phoenix, p. 51.

course length and design, and competition on such courses between institutions. In the meantime, such a facility serves as a self-testing device for vigorous youth, and as a means of contributing to their organic and neuromuscular development.

HARD-SURFACE COURT ACTIVITIES

BASKETBALL

- Space:** As a competitive game, basketball is ordinarily confined to indoor courts, and when played out-of-doors, it is usually in a recreation setting. The official court requires an area 94' x 50', and sufficient space—a minimum of six feet—should be provided outside the boundary lines.
- Surface:** A smooth, hard surface is essential for playing the game, particularly dribbling. A turf area is not satisfactory.
- Orientation:** Courts should be laid out so that the sidelines extend north and south.
- Other Functional Requirements:** A goal, ten feet above the ground, is attached to a backboard of 72" x 48" affixed to supporting standards and suspended four feet inside each end line. Adequate outdoor lighting requires that light sources be suspended well above the surface of the court. It is desirable to have 70 footcandles of light on the playing surface.

DANCE (Folk, Square, Circle, and Social Dancing)

- Space:** Area of 35' x 70' or 70' x 70', which may also serve as a multipurpose area.
- Surface:** Sealed asphalt or concrete.
- Lighting:** Night lighting is feasible. A weatherproof electrical outlet should be provided for attaching a record player and public-address system.

FENCING

- Space:** Hard-surface, multipurpose area 52' to 55' x 75'.
Strips may be painted on surface, allowing minimum of 6 feet between strips. Regulation strips and spacing should be used for all competition.
- Other Functional Requirements:** Lighting for night use. Outlets for public-address system if area is used for competition. (See Chapter 6 for construction details.)

HANDBALL

ONE-WALL HANDBALL

This sport is quite popular in sections of America where it is played. Furthermore, a wall suitable for one-wall handball is a valuable facility for stroke practice in tennis, squash, handball, paddleball, soccer, and other activities.

- Space:** The standard one-wall court is 20' wide by 34' long by 16' high. A wire extension 4 feet high at the top of the wall will improve its usefulness. There should be 6 to 8 feet between adjoining courts, and at least 6 feet is needed on the

sides of a single court and behind the long (end) line. When a common wall is placed between two rows of courts, real economy in its use is effected. A fence or wall 4 to 10 feet high is needed at the backs of courts to decrease ball chasing and interference with activities in other areas.

THREE-WALL HANDBALL

Modifications of the one-wall game are possible when solid wings are constructed along the sidelines 6 feet or farther to permit bank shots in the forecourt.

FOUR-WALL HANDBALL

Outdoor four-wall courts can be constructed for considerably less money than those included within a building. For general construction details, refer to Chapter 6. It is important to note that outdoor courts must be constructed of materials which will resist the steady erosion of sun, water, and other climatic conditions. Walls should be constructed of smooth, hard-finished concrete. Floors should be of concrete, but they should be textured to minimize slipping. A solid ceiling should enclose the front 10 feet of the court, and the remainder of the ceiling and top 8 feet of the back wall should be enclosed with wire fencing or nylon netting. The floor should slope 1 inch in 8 feet away from the front wall, and provisions for removal of water from the area are essential.

LAWN TENNIS

Space:

The official lawn-tennis court is 36' x 78' with 21 to 30 feet of unobstructed space needed behind the base line at each end. A minimum of 12 feet is needed between sidelines and side fences, and 12' to 24' is needed between sidelines of adjoining courts. Additional space is needed in the tennis complex for stroke practice with a rebound net or wall. A space 20' x 30', with a rebound net at one end of the 20-foot dimension, will accommodate two participants using one side of the net. By doubling the 20-foot dimension, the net can be placed in the center and used from both sides, thus serving four participants simultaneously. If a rigid rebound wall is used, the length must be increased from 40 to 60 feet to permit use on both sides, and fences must be placed at the ends to facilitate the retrieving of balls.

Backstops and Side Fences:

Chain-link fencing with a recommended height of 12 feet (10 feet minimum) is needed at the ends of the court complex. This height should be extended around the entire enclosure. If spectators are to be accommodated at the sides of the complex, this fence might be at a lower height from service line to service line in order to permit unobstructed viewing of the activity. A minimum height of 4 feet is recommended for this purpose. Entrance gates should be located at the ends of courts, preferably one between each pair of courts. These locations are desirable as a means of decreasing traffic at the rear of playing courts. Heavy-duty galvanized pipe is recommended, with 2-1/2" O.D. pipe for line posts and 3" O.D. pipe for corner posts if no wind screens are to be affixed to the fence. If wind screens are to be supported, stronger posts must be specified. Posts must be securely embedded in concrete footings.

Net Posts and Fixtures:

Standard net posts of heavy-duty pipe with proper net-tightening reel, cable hooks, and top cable supports are available commercially and their use is recommended. These must be located 3 feet outside the doubles sideline in order to provide 42 feet clearance for the official net and still assure regulation net height at the sides. These posts must support the net cable at an exact height of 3'-6", and they

OUTDOOR ACTIVITY AREAS

must be firmly embedded to a depth of 3'-6" in concrete footing (more if frostline is a problem). A center strap anchor located at midcourt under the net must also be firmly anchored in a concrete footing regardless of the surface used. The top of this anchor should be flush with the court surface and designed to permit a harness snap attachment from above.

Surfaces:

A variety of tennis-court surfaces are available. This complicates the problem of decision-making, but it also makes possible much more satisfying results if sufficient effort is expended to select the right surface for the local situation. Table 7, which is taken from a recent publication of the United States Lawn Tennis Association,⁴ classifies three general types of surfaces and summarizes the specific qualities of each. This same publication includes good descriptions and critiques for each of these surfaces.⁵ Because local conditions differ so greatly, it is not possible to recommend specific surfaces which would be adaptable to all situations.

Officials in colleges and universities who seriously desire to develop a tennis program will have need for two types of surfaced courts. One group of at least ten courts should be constructed of nonporous, noncushioned material (see Table 7) to provide for instructional and general recreational needs. These courts are durable, require a minimum of maintenance and supervision, are available for use a maximum amount of time, and provide very good playing conditions.

A second group of at least six courts may be constructed of the better nonporous cushioned materials, or the best of the porous materials, and should be carefully supervised and maintained for use by the competitive and more sophisticated tennis groups of the campus community. The surfaces for this second group of courts require careful supervision and maintenance, and unless these provisions can be assured, these surfaces should not be selected.

Among other factors to be considered in selecting the surface are the availability of materials, the skill and experience of those who will construct the courts, climatic conditions, and the needs and desires of those who will use these areas.

Grading:

A perfectly flat tennis surface provides the best playing conditions and should be included in the indoor facility. However, because drainage is a factor in outdoor courts, these must be graded 1 inch to 10 feet for nonporous courts. This slope must be from one side of the court to the other. Other methods of grading are not recommended because they provide inferior playing conditions.

Orientation:

The long axis of the tennis court should normally be north and south. In central and southern regions of the United States, the rotation of 20° to the northwest and southeast will provide more equal conditions of play. Otherwise, the player facing the south must look into the sun during the fall, winter, and spring seasons. Where there are strong prevailing wind conditions, the courts should be located in a sheltered area. Movement, distractions, and unfavorable backgrounds can be eliminated by the addition of dark-colored wind curtains.

⁴ United States Lawn Tennis Association, *Tennis Courts: Construction, Maintenance, and Equipment*, 1966, pp. 10-11.

⁵ *Ibid.*, pp. 15-43.

Lighting:

Lighting is highly recommended as a means of extending the use of the courts, and, especially during the hot summer months, of providing more pleasant conditions for play. Detailed plans and recommendations are available, and these, together with local illumination specialists, should be consulted when planning to install lighting. Outdoor lighting should provide a minimum of 30 footcandles. If television is contemplated, much more light will be needed. (See Chapter 6 for recommendations concerning the design and construction of indoor tennis facilities.)

PADDLE TENNIS

- Space:** Court dimensions 20' x 44' (doubles court). Overall space requirements 30' x 84'.
- Other Functional Requirements:** 8 to 10 feet between courts. Net posts should be removable, but set in sleeves.

PLATFORM PADDLE TENNIS

- Game Type:** Platform tennis is an outdoor game which combines many of the features of tennis and squash. It is played on specially-constructed platforms. Balls which first strike the court area may be played off the wire as in squash.
- Space:** Overall size of platform 30' x 60'.
Dimensions of court 20' x 44'.
Height of backstop 12 feet.
- Orientation:** Courts should run north and south.
Platform should be close to service buildings.
Avoid location where shadows make it difficult to see ball.
- Other Functional Requirements:** Wiring around court: 16-gauge, 1-inch mesh, 6-foot wide strips, stretched tight vertically and clamped together.
Evans-type back and side stops, with adjustable tension bars.

ROLLER SKATING

- Space:** Dimensions for a championship speed-skating track are based on 14 laps to the mile. Speed skating requires an oval track with a minimum width of 20 feet and a minimum length based on 24 laps to the mile. An area 108' x 120' (the area required for two doubles tennis courts) will accommodate 70 skaters.
- Surface:** Hard-surface, multipurpose area. The surface should be smooth enough so that it is not hazardous to the skaters. It should be hard enough so skates will not cut through the surface.
- Other Functional Requirements:** A weatherproof electrical receptacle, or accessibility to an indoor outlet so a record player may be attached.

SHUFFLEBOARD

- Space:** Court dimensions 6' x 52'.
Maximum width of dimension lines 1-1/2"
Minimum width of dimension lines 3/4"

TABLE 7
CHART COMPARING VARIOUS TENNIS COURT SURFACES

Court Type	Repairs May Be Costly	(1966 prices)*		Maintenance	Av. Time Before Resurfacing	Resurf. Cost (1966 prices)	Other Uses	Surface Hardness	Ball Skid Length	Ball Spin Effective	Colors	Drying Time After Rain	Is Ball Bounce Uniform	Stains Ball & rackets)	Abrasive Surface (hard on shoes & rackets)	Humidity** Problem Indoors	Slide Surface	Lines Affect Ball Bounce
		Initial Cost Per Court	Ind. Base															
POROUS																		
Fast Dry	no	3500-5000	no	daily and yearly care	10 yrs.	1500	yes	soft	short if damp court	yes	green	fast	yes (if maintained)	some do	no	yes	yes	yes
Clay	no	2000-3000	generally yes	daily and yearly care	5 yrs.	1000	yes	soft		yes	red	slow	yes (if maintained)	yes	no	yes	yes	tapes
Dirt	no	1500-2000	yes	daily and yearly care	3 yrs.	500	yes	soft	long if dry court	yes	varies	slow	yes (if maintained)	yes	no	yes	yes	tapes
Grit	no	1500-2000	yes	daily and yearly care	3 yrs.	500	yes	soft		yes	varies	slow	yes (if maintained)	yes	no	yes	yes	tapes
Grass	no	6000-8000	no	daily and yearly care	indefinite	varies	yes	soft	moderately long medium	yes	green	slow	irregular	yes	no	won't grow	yes	no
Special (Porous concrete)	yes	8000-10,000	no	very minor	3 yrs. (if colored)	1500-2500	yes	hard		yes	wide variety	fast	yes	no	yes	no	no	no
NON-POROUS NON-CUSHIONED																		
Concrete	yes	6000-10,000	no (if colored)	very minor	3 yrs. (if colored)	1500-2500	yes	hard	long if glossy court finish if gritty	no if glossy finish	wide variety	fast	depends on installation	no	varies	no	no	no
Asphalt Plant Mix (Colored)***	no	3000-4500	no	very minor	5 yrs.	800-1500	yes	hard	medium court finish	yes if gritty	wide variety	fast	yes	no if colored	no if colored	no	no	no
Asphalt Job Mix (Colored)	no	3500-5000	no	very minor	5 yrs.	800-1500	yes	hard	short	gritty finish	wide variety	fast	yes	no if colored	no if colored	no	no	no
Asphalt Penetrated Macadam	no	3000-4000	no	very minor	5 yrs.	800-1500	yes	hard	medium	yes	wide variety	fast	yes	no if colored	no if colored	no	no	no
Asphalt integrally Colored Mix	no	4000-6000	no	very minor	5 yrs.	2500	yes	hard		yes	wide variety	fast	yes	no	yes	no	no	no
Wooden	no	8000	no	very minor	indefinite	varies	yes	hard	long	no	wide variety	fast	yes	no	yes	no	no	no
NON-POROUS CUSHIONED																		
Asphalt Bound System (Colored) Synthetic	no	4000-6000	no	very minor	5 yrs.	800-1500	no	soft	long if glossy finish, short if gritty	no if glossy finish	wide variety	fast	yes	no	no	no	yes	no
Synthetic Grass	no	6000-12,000	no	very minor	varies	varies	yes	soft	medium to short	yes	green	fast	yes	no	no	no	slight	no
Removable	no	9000-13,000	no	very minor	varies	varies	yes	soft	short	yes	green	slow	yes	no	no	no	yes	no
	no	6500-12,000	no	very minor	varies	varies	yes	soft	varies, shortest to longest	yes	variety	fast	yes	no	no	no	slight	no

*Not including fencing or site preparation.

**New surfaces now in experimental stage that require little watering, thus reducing indoor humidity problems.

***Colored playing surface.

+Yes if granules imbedded.

++Yes if constructed with top granules loose.

Courtesy of U.S. Lawn Tennis Association, New York, N.Y.

OUTDOOR ACTIVITY AREAS

Surface: Smooth concrete, terrazzo, or sealed asphalt
Orientation: Locate courts in relatively-quiet area with some shade.
Lighting: Night lighting feasible.

VOLLEYBALL

Space: Court dimensions 30' x 60'.
6 feet minimum out-of-bounds space
Surface: Smooth, hard surface or level turf
Orientation: Courts should be laid out so that side-lines extend north and south.

Other Functional Requirements: Net posts, equipped to support nets at official heights—**Men:** net height 8'. **Women:** net height 7'-4 1/4".
Pipe sleeves mounted in concrete for ease in removing poles.
Adequate lighting should be provided for night play.

WEIGHT-EXERCISE FACILITY

Weight training and other developmental activities can be economically and effectively promoted in the out-of-doors during favorable seasons of the year. Because some aspects of the out-of-doors are desirable while others detract from the activity (sun, wind, heat, cold), outdoor weight-lifting areas should be located near shelters and windbreaks.

If the outdoor weight-exercise facility is to be of value in the program during marginal (cold) weather, the provision of overhead radiant heat should be considered.

For the security of equipment and to protect it from the elements, a sheltered equipment-storage area is needed. Equipment or apparatus which is permanently installed in the open should be designed and constructed so as to require a minimum of maintenance.

Surfaces recommended for the indoor facility (see Chapter 6) may serve equally well outdoors. In addition, some use may be desired for concrete or bituminous materials, turf, clay, and loose sand.

OTHER AREAS

BOCCE

Space: Court dimensions 15' x 75'
Total area desirable 33' x 81'
Safety: Safety area 3 feet lengthwise; 9 feet on each end
Surface: Level surface of a mixture of sand and clay
Orientation: Shaded area desirable

CROQUET

Game Type: Court - 2 to 8 players
Space: Court dimensions 28' x 70'
Total area desirable 34' x 76'
Safety: Safety area 3 feet lengthwise; 3 feet on each end
Surface: Close-cropped turf or loam

HORSESHOES

Space: **Men**-10' x 50'—**Women**-10' x 40'. (This allows for a space of 2 feet behind each pitcher's box.)

Adjacent Courts: There must be at least 10 feet between stakes of adjacent courts, and in tournament play, front foul lines of pitching boxes must be aligned.

Pitching Distance: **Men**-40 feet—**Women**-30 feet (optional), measured between stakes at either end of court.

Pitchers Boxes: Location—2 feet from each end of court, measured to back ends of boxes, respectively. Dimensions—6 feet square, inside measurement. Material—frame of wood joists; filling of potter's clay or other material of like nature, 6" deep. A stake must be placed in exact center of each box. Clay or other filling of box must be kept in moist condition in area immediately surrounding stake. If desired, a hard surface may be used, in which case an area of 31" x 43" must be left open around stake, to be filled with clay.

In outdoor courts, wooden frame must be set in ground flush with surface, except at front of box, where it must extend approximately 1 inch above surface of ground; foul lines surrounding each box must be clearly defined. In indoor courts, boxes must not stand more than 6 inches above floor.

Throwing Platforms: No official specifications. However, heavy outdoor plywood or plank throwing platforms, 12 to 18 inches wide, are sometimes placed over surface, and along-side edges of pitchers' boxes, to give sure footing.

Stakes: Material—iron pipe or steel rods with diameter of 1 inch. Each stake must extend 14 inches above surface of pitcher's box, with an incline of 3 inches toward stake at opposite end of court. Imbedding stakes in concrete will assure uniform height and inclination, and prevent removal.

Other Functional Requirements: Horseshoe courts need no special directional orientation. They can be constructed singly or in batteries of several courts in a row to the extent of area available. A box constructed of heavy plywood or planking for the storage of shoes is very desirable. It should be secured with a padlock and located adjacent to the playing site.
It is recommended that indoor courts have a ceiling height of at least 15 feet.

LAWN BOWLING

Game Type: Bowling—usually played with a four-man team

Space: Bowling green 120' x 120' surrounded by a ditch not less than 10 inches wide and not less than 6 inches below the land of the green. The ditch should be surrounded by a bank not less than 9 inches above the green. The green is divided into eight 14' x 11' rinks.

Surface: Close-cropped turf or loam

QUOITS

Game Type: Individual or dual pitching
Space: **Women**-12' x 44', with a pitching distance between pins or stakes of 30 feet
Men-25' x 80', with a pitching distance between pins or stakes of 54 feet
Surface: Level turf or asphalt area
Orientation: North and south

ROQUE

Game Type: Mallet-and-ball game
Space: 30' x 60'
Surface: Smooth, flat, and level; of a sand-clay mixture or asphalt sprinkled with fine sand. The border should be of wood or concrete with an iron rim for better rebound deflection. This border should be not less than 5 inches high. A painted or taped boundary line should be 28 inches inside the curb. Steel arches are set into concrete blocks below the surface.

SELECTED REFERENCES

Blanchard, Fessenden S., *Platform Paddle Tennis*. New York: William Morrow Co., Inc., 1959.

Butler, George D., *Recreation Areas: Their Design and Equipment*. New York: Ronald Press Company, 2nd ed., 1958.

Delamater, James B., *The Design of Outdoor Physical Education Facilities for Colleges and Schools*. New York: Bureau of Publications, Teachers College, Columbia University, 1963.

Division for Girls' and Women's Sports, *Archery-Riding Guide*. Washington, D.C.: American Association for Health, Physical Education, and Recreation, 1201 Sixteenth St., N.W. 20036. (Current year). *Bowling-Fencing-Golf Guide*. Washington, D.C.: AAHPER, (Current Year). *Field Hockey-Lacrosse Guide*. Washington, D.C.: AAHPER, 1966. *Soccer-Speedball Guide*. Washington, D.C.: AAHPER, 1966. *Tennis-Badminton Guide*. Washington, D.C.: AAHPER, 1966. *Volleyball Guide*. Washington, D.C.: AAHPER, 1967.

Gabrielsen, M. A., and Miles, C. M., *Sports and Recreation Facilities for School and Community*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1958.

Golf Instructor's Guide and Golf Operator's Handbook. Chicago: National Golf Foundation, Inc.

Participants in National Facilities Conference, *Planning Areas and Facilities for Health, Physical Education, and Recreation*. Chicago: The Athletic Institute, and American Association for Health, Physical Education, and Recreation (NEA), 1965.

Piper, Ralph A., *Night Football*. Minneapolis: Burgess Publishing Co., 1941.

Chapter 9

SERVICE AREAS

Service areas are used primarily for the health, safety, comfort, and convenience of the participants in a program of physical education, athletics, and recreation. These facilities include such areas as dressing-locker rooms, shower rooms, toweling rooms, toilet rooms, storage and central equipment supply rooms, matron and custodial areas, and training and first-aid rooms.

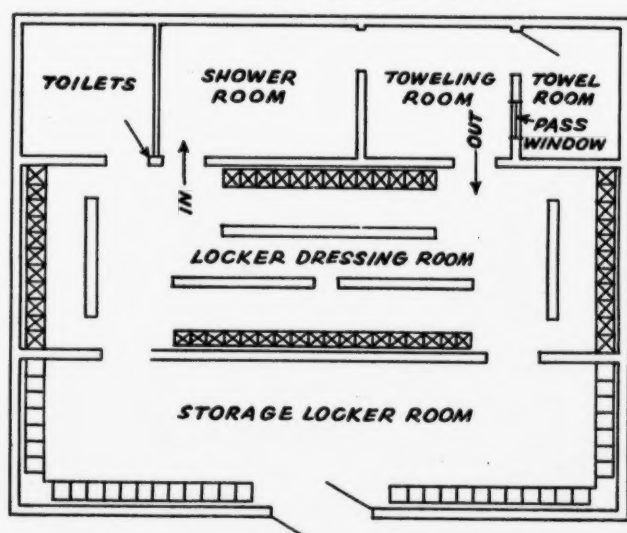
DRESSING-LOCKER ROOM

LOCATION

The locker room should be located to serve functionally the indoor and outdoor teaching stations and activity areas. It is recommended that dressing-locker rooms be located above ground level. Students should be able to pass from locker rooms to activity areas without crossing main paths of traffic in corridors. Such rooms should be easily accessible to the shower room, instructors offices, equipment rooms, and toilets.

In some plans, it may be desirable that a separate service area be developed to serve the swimming pool area. In passageways from the outdoor activity areas, special drains equipped with a mud crock should be located at the entrances. Provision for flushing and cleaning such areas is also needed.

TYPE I. AN ILLUSTRATIVE ARRANGEMENT FOR DRESSING ROOM



This Arrangement Separates the Clothing Storage and Dressing Areas

Figure 24

SIZE

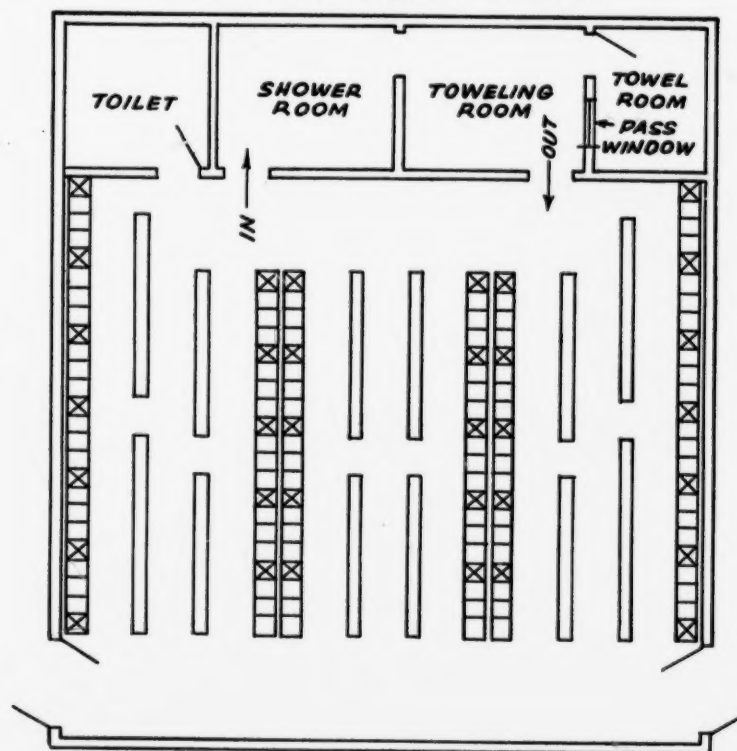
The dressing-locker room size should be based on the number of students enrolled in the college or university and the number of students using the facility during peak loads. It is recommended that, in planning, allowance be made for projected enrollment.

Using a minimum of 20 square feet per person, additional space should be allowed for faculty, graduate assistants, intramural sports participants, and participants and coaches in intercollegiate athletics.

PHYSICAL FEATURES

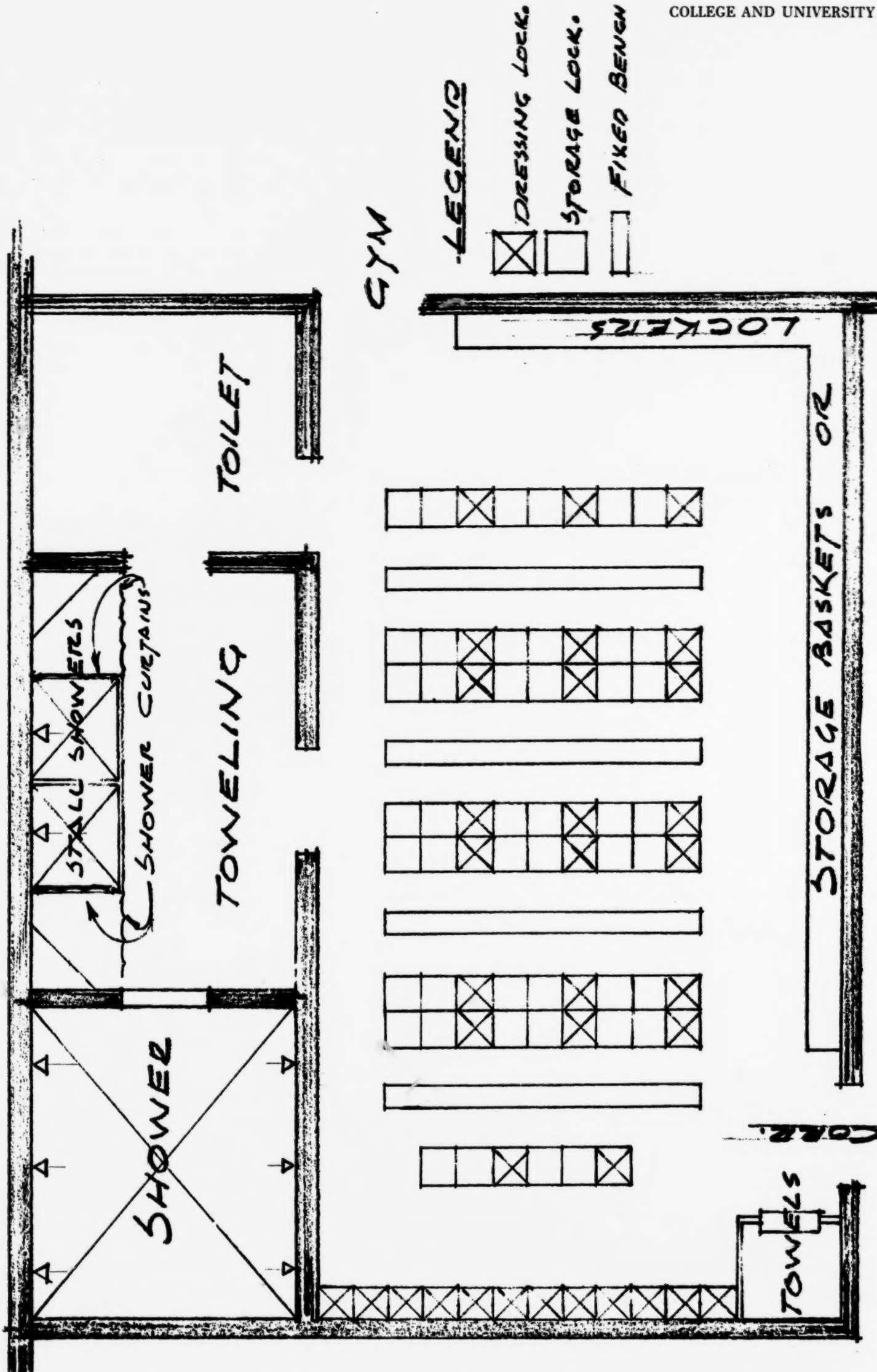
Consideration should be given to the factors which influence the shape and size of locker rooms, and space requirements for benches, lockers, storage, toilets, showers, circulation of pupils, and toweling rooms. Figures 24, 25, and 26 indicate several possible arrangements.

TYPE II AN ILLUSTRATIVE ARRANGEMENT FOR DRESSING ROOM



This Arrangement Combines the Clothing Storage and Dressing Areas

Figure 25



COMBINED CLOTHING STORAGE & DRESSING AREAS FOR GIRLS.

Figure 26

SERVICE AREAS

Floors should be of nonskid impervious materials, such as ceramic or quarry tile, with a carborundum-impregnated surface, and should be properly sloped toward the drains. Concrete floors (nonskid surface), although not recommended, should be treated with a hardener to prevent the penetration of odors and moisture. Low humidity should be maintained in the locker rooms. The locker bases should be 8 inches high, should be coved, and of the same material as the floor.

Walls should be of moisture-resistant materials and should have easily-cleaned surfaces. All corners in the locker room should be rounded.

Heavy-duty, moisture-resistant doors should be installed at entrances and exits of the locker rooms, should be of sufficient size to handle the traffic flow, and be in a position where they form natural vision barriers. All outside doors from the locker rooms should be equipped with panic bars of noncorrosive metal.

Locker rooms should be well lighted with vaporproof light fixtures. The ceilings should be acoustically treated with a material impervious to moisture. The layout of the lockers should be such that the lights are directly over the spaces between the lockers. Electrical outlets should be located approximately 3 feet above the floor level and should be vaporproof. Floor drains should be properly placed in the locker room to permit complete drainage and cleaning.

It is recommended that special attention be given to the use of color on floors, walls, and lockers (see Chapter 4). Drinking fountains should be provided at strategic locations.

An ample supply of mirrors should be installed in "vanity" areas. Full-length mirrors should be strategically located and placed at least 12 inches above the floor.

If the dressing-locker room serves the swimming area, hair dryers in the ratio of 1 to 4 swimmers has proved satisfactory. It is desirable to have dryers at varied heights and grouped in one or several areas. In each of the other dressing-locker room areas, it is recommended that a few additional hair dryers be installed. Hood dryers are preferred by many women and should be considered in the planning.

SHOWER ROOMS

Shower rooms should adjoin the dressing-locker rooms. If more than one dressing-room area is to be served, the shower room should be centrally located and large enough to serve the peak loads of all the areas.

Shower rooms should be separated from dressing rooms by a low curb, and by the toweling area. Adequate ventilation and humidity control are essential. Air should be exhausted 100 percent to the outside. Temperature control and pressure regulation of shower water are important.

Floors should be of nonskid, impervious ceramic tile, quarry tile, terrazzo, or the equivalent, pitched away from dressing-locker rooms toward adequate drains. These drains should be covered by removable nonferrous metal grating. Hose bibbs, while not located in the shower room for safety reasons, should be placed in the adjacent dressing-locker room area. Where possible, hose bibbs should be placed under the lavatories and the hose should be equipped with aerating or nonsplash nozzles.

Ceilings should be moisture-resistant, acoustically treated, and a minimum of 9 feet high. All lights should be vaporproof. Light switches should be so installed that, if desirable, the lights may be operated from the central room or the attendant's office in the area. For safety purposes,

all electric switches should be located in dry areas of the shower and dressing-locker rooms.

It is recommended that all types of shower installations be considered. Among those to examine are: (1) the center-post installation; (2) installation along the outside wall; (3) overhead installation; and (4) progressive walk-through installation. In some situations, the gang shower is preferred, with shower heads at four-foot intervals. Where facilities are used constantly by individual players, or small groups, the separate shower with individual control is recommended.

Where possible, all plumbing for the showers should be placed in pipe spaces so the pipes are readily accessible when repairs are needed. The height of the shower heads should be such as to direct the flow overhead for men, and at shoulder height for women. Self-cleaning shower heads, and ease of maintenance are other factors to be considered.

In shower areas for women, group showers are becoming more popular. For semiprivacy, low dividers approximately 6 feet high may be used between shower heads (see Figure 27).

At least 10 percent of the shower heads should be in individual shower booths. These individual showers should be located at the side of the toweling room. It is recommended that the shower heads in individual showers be adjusted for shampoo use.

The walls should be of ceramic tile, terrazzo, glazed tile, or similar impervious material. If wainscots are used, they should extend to a height of at least seven feet.

A soap dispenser should be located at each shower head if a soaping area is not provided. Gravity-flow, liquid-soap dispensers are desirable. The soap outlets should be supplied from a central reservoir of sufficient size to hold several days' supply. For custodial control, this reservoir should be located outside the shower space if possible.

TOWELING AREA

The toweling area should have the same amount of floor area as the shower room, and should be immediately accessible to both shower and locker rooms through an entrance to each. Floors should be of the same material as used in the shower room. Walls should also be of this material, except that the tile need extend upward only to a height of approximately 5'-6" from the floor. Provision should be made for drainage.

If the wall between the toweling area and the dressing room extends to the ceiling, the ceiling should be of the same material as that used in the dressing room. Heavy-duty, noncorrosive towel rails, approximately 4 feet from the floor and securely fastened to the wall, are recommended. A large foot-drying ledge 18 inches high and 8 inches wide, with a bull-nose edge, should be provided. This should be made of the same material as the walls and should be coved at the wall and at the base. Benches should not be installed in this area.

TOILET ROOMS

Toilet facilities should be provided in the following places: central locker rooms; auxiliary dressing rooms; and adjacent to shower, toweling, and trainers' rooms. Toilets for public use should be conveniently available to the foyer and spectator areas.

Toilet and lavatory facilities should be provided in proportion to the peak-period loads in the central locker rooms and auxiliary dressing rooms. In the planning of toilet facilities, provision should be made for direct access to outdoor activity areas.

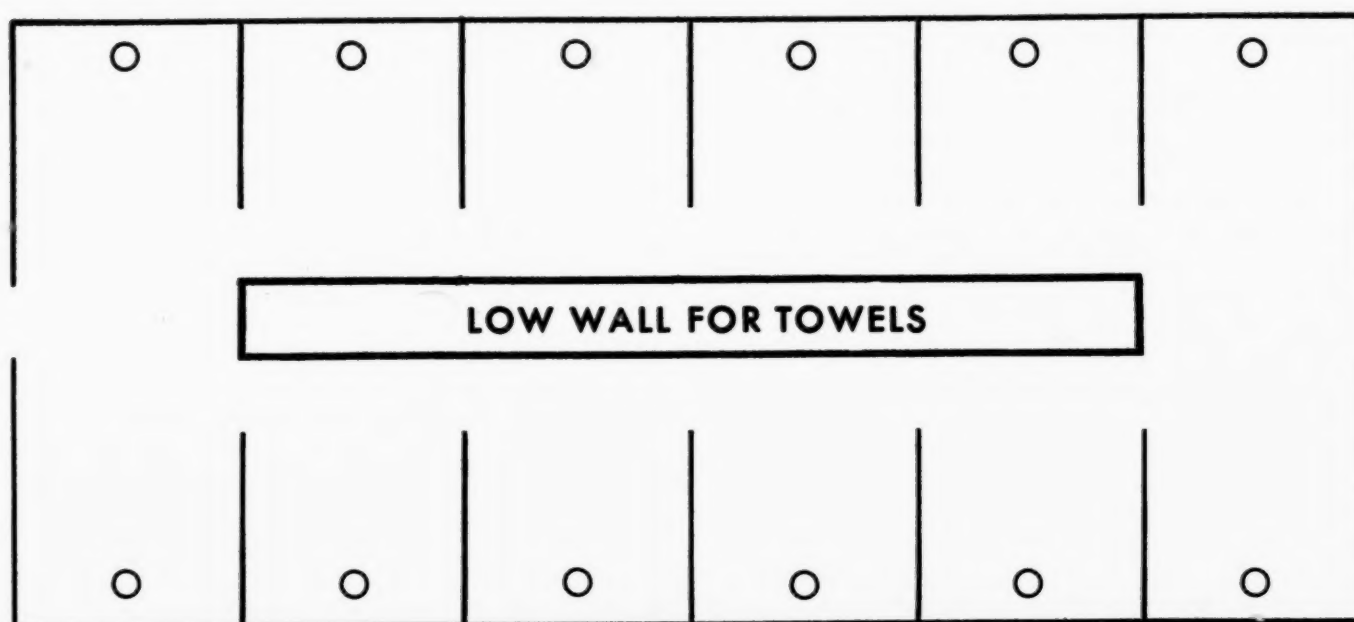


Figure 27
Divided Group Shower

In the men's central locker-room area, there should be a minimum of two water closets, two urinals, and two hand lavatories for the first 30 students. Additional fixtures should be provided as follows: one urinal for every 20 students, one lavatory for every 20 students, and one water closet for every 30 students. In the women's central locker room area, there should be a minimum of four water closets and two hand lavatories for the first 30 students. Additional fixtures should be provided as follows: one water closet for every 15 students and one lavatory for every 20 students.

Provision for either paper-towel dispensers or electric hand dryers is necessary. Adequate waste containers are also needed. In toilet areas for women, sanitary dispensers and sanitary disposers should be provided.

Stalls should be securely anchored to the ceiling and walls. For ease in cleaning, fixtures should be wall-hung so that the floors are clear. All outside doors should close automatically and, where necessary, be baffled to obstruct sight lines. The placing of mirrors over hand lavatories should be avoided. The mirrors should be placed above a wall return. See Appendix G for information concerning shower facilities for the disabled.

LOCKERS

Lockers are needed for all participants who will use the dressing-locker rooms. Storage lockers should be provided for physical education uniforms and certain personal game equipment that may be stored conveniently between activities. Dressing lockers for street clothing, personal effects, and books should be provided for use during activity periods. The number of lockers should be equal to the peak-period load plus adequate allowance for overlapping classes, variations in class size, scheduling, and use by intramural, recreation, and intercollegiate participants. Projected enrollment is another factor to consider.

There are several locker systems to be considered: the box-locker or post-office plan; the tote-basket plan; the storage-locker-plus-dressing-locker plan; and the individual-locker plan. The following guide lines are suggested for use in determining which system will be installed: (1) the need to safeguard street clothing as well as physical education uni-

forms; (2) the utilization of facilities to the greatest advantage; (3) the keeping of odors to a minimum; (4) the saving of the time of the student; and (5) the administrative feasibility and cost.

For institutions that provide for laundry of the uniform, the box-locker plan, served by an attendant from inside the storage or issue room, has advantages. This plan saves the time of the student in that the soiled uniform may be changed when the area is not being used. This system also utilizes space more economically. In addition, odors in the building are cut to a minimum due to the daily change of soiled apparel. However, the operational cost of the box-locker system may be higher than for other plans because of increased labor costs of attendants.

In the tote-basket system, the tote baskets are stored on shelves inside the storage room and issued through windows, or stored on dollies or racks and moved to the dressing-locker room. Pilferproof baskets may also be stored and locked on open shelves in the locker room. The tote-basket system requires fewer standing lockers than the individual-locker plan. Some disadvantages of the tote-basket system are: (1) the baskets are fragile; (2) they can be misplaced or incorrectly returned; and (3) they require more supervision. This system can prove ineffective when there is a rush of users during peak periods. If dollies are used in this system, they may be placed in a small area to enable the equipment stored on them to dry faster.

Units of lockers, in which storage lockers are in combination with dressing lockers, may also be considered. The major problem with the unit system is poor ventilation through obstruction created by long rows of locker units of excessive height. Where lockers are used, it is recommended that combination locks be furnished by the institution.

Stand-up dressing lockers should be raised off the floor on coved bases of impervious materials. These lockers should be of sufficient number to take care of the peak period of dressing-room use. In addition, extra lockers should be included to allow for expansion and enrollment increases. When banks of lockers are placed throughout the room, supervision is facilitated by setting them perpendicular to the supply room, the dispensing area, or the instructor's office.

TYPICAL COMBINED STORAGE-DRESSING LOCKER ARRANGEMENTS

and
LOCKER AREA REQUIRED FOR DIFFERENT TYPES OF STORAGE-DRESSING UNITS

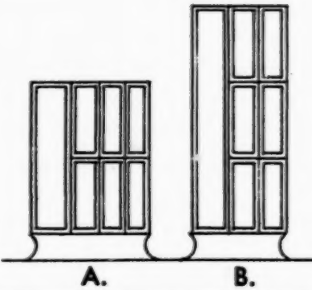
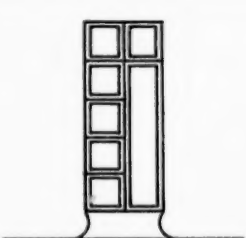
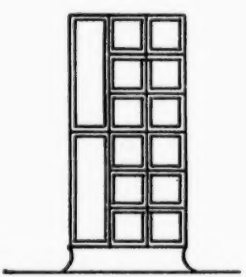
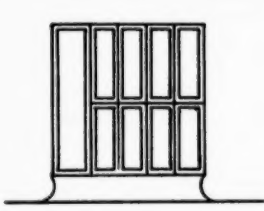
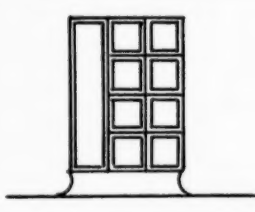
ADAPTATION	SIZE OF LOCKERS AND BATTERY ARRANGEMENT	ARRANGEMENT OF LOCKERS ONE PUPIL EACH PERIOD	OVER-ALL HEIGHT WITH 8" BASE	NUMBER STUDENTS PER DAY	AREA REQUIRED INCLUDES 4" FOR VENTILATION
6-PERIOD DAY	A [6 STORAGE 9" x 12" x 24" 1 DRESSING 12" x 12" x 48"		A. 56"	240	A [152 SQ. FT.
	B [6 STORAGE 9" x 12" x 24" 1 DRESSING 12" x 12" x 72"		B. 80"		B [115 SQ. FT.
6-PERIOD DAY	6 STORAGE 9" x 12" x 20" 1 DRESSING 12" x 12" x 60"		68"	240	115 SQ. FT.
6-PERIOD DAY	6 STORAGE 12" x 12" x 12" 1 DRESSING 12" x 12" x 48"		56"	240	93 SQ. FT.
6-PERIOD DAY	12 STORAGE 12" x 12" x 12" 2 DRESSING 12" x 12" x 36"		80"	240	133 SQ. FT.
7-8-PERIOD DAY	8 STORAGE 9" x 12" x 24" 1 DRESSING 12" x 12" x 48"		56"	320	187 SQ. FT.
7-8-PERIOD DAY	8 STORAGE 12" x 12" x 12" 1 DRESSING 12" x 12" x 48"		56"	320	133 SQ. FT.

Figure 28

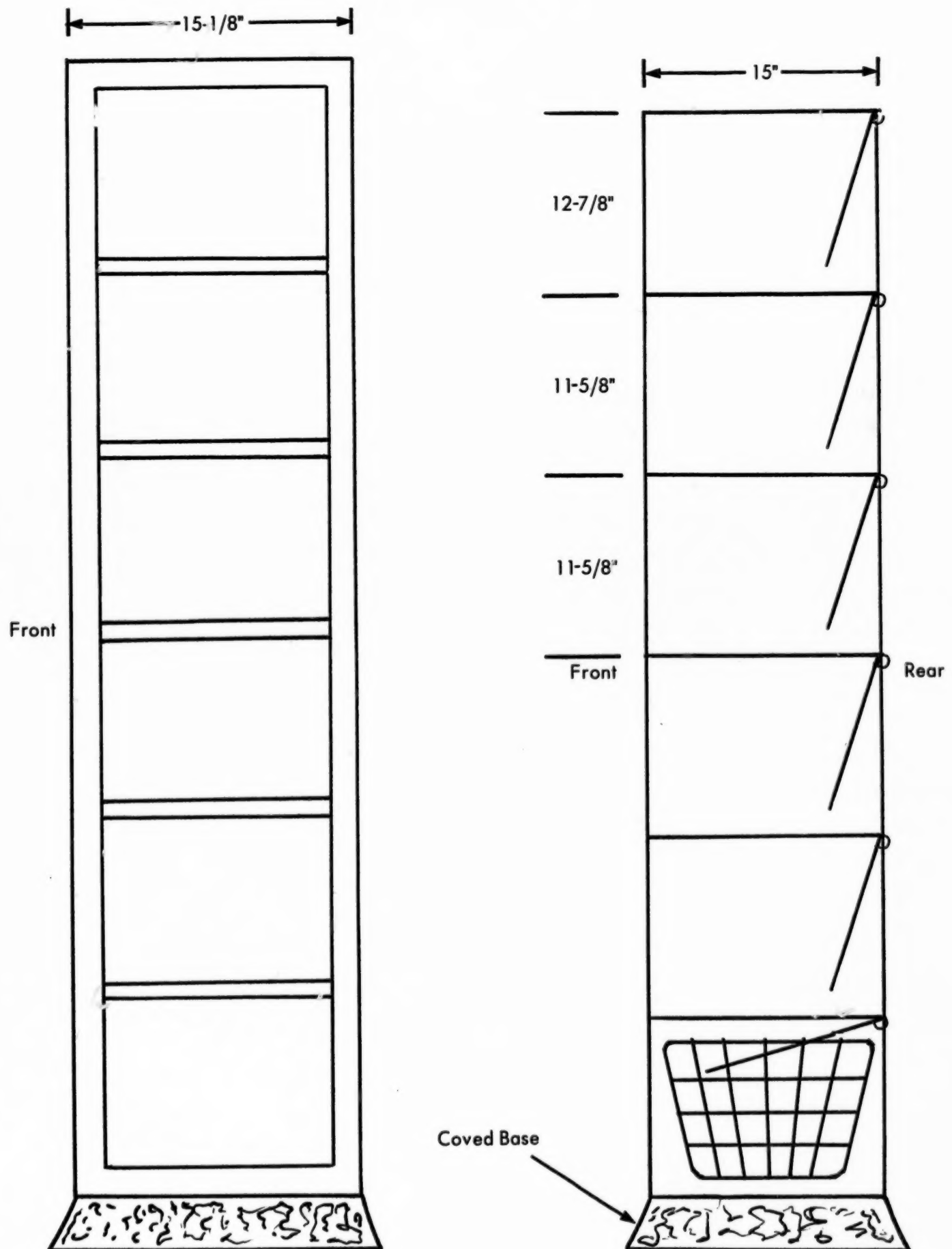
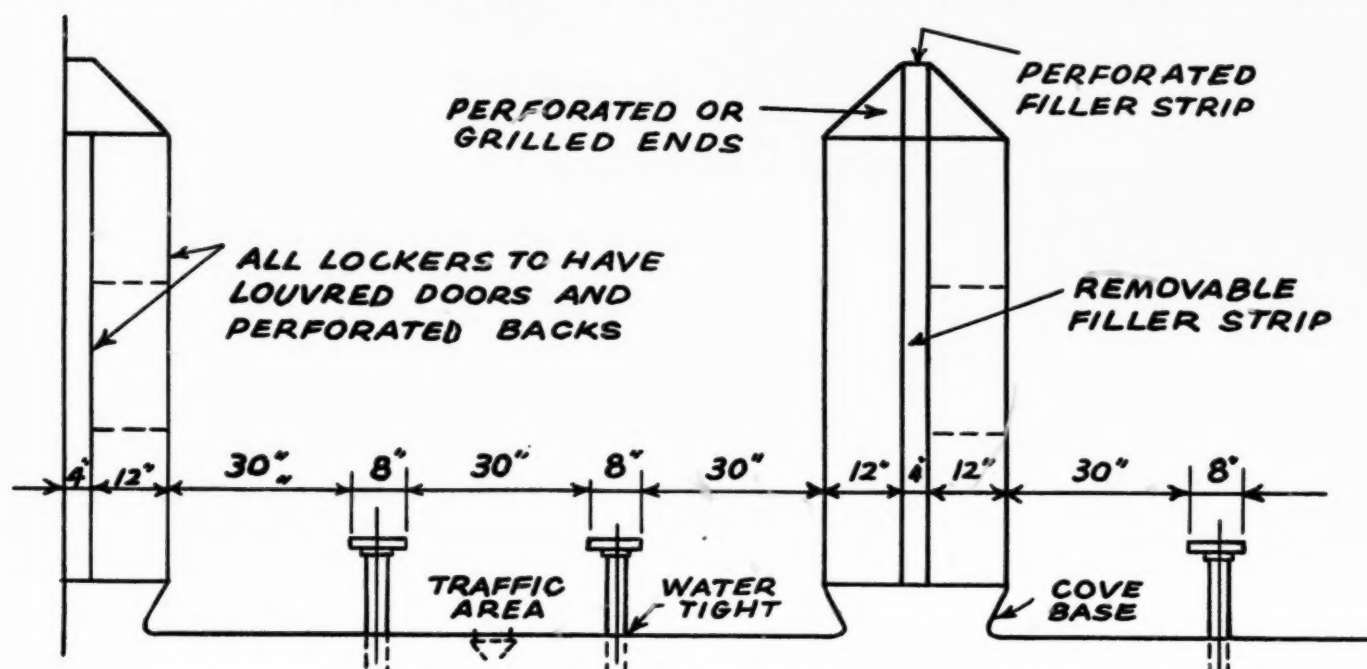


Figure 29
Front and Side View of Post-Office Box Lockers, Showing Doors, Baskets, and Markers in Rear

DETAIL OF LOCKER AND BENCH INSTALLATION



Note: Locker heights and widths are variable.

Figure 30

It is recommended that positive ventilation be used in all lockers as well as in locker-shower rooms.

Benches should be secured to the floor. A seat board of hardwood, at least 8 inches in width, surfaced on four sides, with rounded edges and corners, is essential. The height of the bench should be 16 inches from the floor. Space relations of lockers to bench, and bench to bench should be planned for traffic control and dressing comfort. The recommended allowances are 30 inches from lockers to bench, 8 inches for bench width, and a 30-inch passage between benches. Benches should extend the full length of each locker bank, with traffic breaks at intervals of about 12 feet (see Figure 30). The architectural design should facilitate housekeeping.

Team locker rooms which incorporate storage-hanger-locker-beds that may be used by visiting teams merit consideration.

STORAGE AREAS

Conveniently-located and carefully-arranged storage areas contribute to the efficiency of physical education programs. A "rule of thumb" that has been used is allowance of 250 to 300 square feet of storage space for each exercise area in the facility. Storage should adjoin the exercise area served to save the instructor's teaching time. Moreover, the housekeeping in the building benefits from adequate storage space.

Although it is impossible to describe all storage needs, the following suggestions should be helpful:

- Provision should be made for dead storage of seasonal equipment.
- Fire laws must be observed relative to the storage space used for combustible items such as archery targets.
- If possible, storage of equipment for field sports should be located near the field exits. If needed, small field storage sheds should be constructed.
- Walk-in storage areas for large equipment (e.g., tables for recreational sports, and gymnastic equipment) should have double doors with flush sills. Door heights to accommodate passage of such items as a folded trampoline or net standards are necessary.
- Racquet-sports equipment, fencing foils and masks, and archery bows may be hung from hooks on quarter-inch pegboards.
- Tilted shelves or noncorrosive bars are convenient for ball storage and items such as masks of various kinds. Installing these shelves about an inch from the wall facilitates cleaning. Level shelves are needed to store such items as hockey sticks on a flat surface. Bins for ball bats are convenient.
- In classrooms, closets to house audiovisual equipment and laboratory models are needed.
- In the dance-studio complex, walk-in storage, racks for hanging costumes, and closets with shelves for leotards and small dance accessories should be provided. A percussion storage room with humidity controls will extend the life of expensive instruments.
- Where no storage room is planned for pool equipment, it is suggested that racks for a canoe be placed parallel to the pool at one corner of the pool room where traffic is light. Enclosed cabinets should also be provided to accommodate such items as racing lane markers, kick boards, and other pool accessories. In addition, a closet to house the pool vacuum cleaner is needed.
- Where athletic equipment must be stored in the central storage room, several precautions need to be observed. Large workbenches will be needed for folding and sorting. Open-end cubicles facilitate the storage of helmets, pads, shoes, and other bulky items, and also provide for free circulation of air. Cedar-lined closets can serve to safeguard woolen goods.

LAUNDRIES

One or more laundry rooms may be needed, depending upon the activity program. For example, football uniforms require a different type of treatment than that for dance leotards. A central laundry to care for towels and apparel would require extensive equipment, and demand the services of a full-time laundry attendant. Breakdowns in equipment and/or the scheduling of varied fabrics for laundering could result in a breakdown in the total program. Diversified, smaller laundry units might, in an emergency, be able to provide some interim service for another unit.

Some guide lines to the planning of a laundry unit are as follows:

- The size of equipment (washer-extractor plus dryers) depends upon the laundry cycle (daily and/or weekly work loads). Therefore, the peak load for the cycle chosen must be used as the base for the calculation. An item such as a towel must be accurately weighed and its dry weight multiplied by the peak load to help determine the size of the equipment needed.
- The size of the equipment under consideration determines the size of the foundation required. Pads are used to assist in the prevention of vibration.
- The size of the equipment and its power demands will determine the electrical, steam, or gas and plumbing requirements. Oversize drains and vents are needed.
- The size of the equipment considered must be such that the space it occupies will allow room on all sides for necessary repairs.
- When feasible, laundry chutes should lead from the area of use into the laundry room.
- Space in the room is needed for a supply dolly and tables for folding laundry.
- Access to this room should be directly off a corridor, and, if possible, the room should be near a delivery entrance with double doors and flush threshold.
- Adequate attention must be given to humidity factors in this room.
- The floor should be of a nonskid material that is easy to clean.
- Lighting should be vaporproof.

MATRON'S SERVICE AREA

Women's dressing-shower areas should be serviced by matrons. They may clean as well as protect these areas. In those areas serving as dispensing units for bathing suits, leotards, towels, and/or other physical education clothing, a counter with a roll-up window is advised. Suits and towels may be stored on the counter shelves.

A Dutch door enables the matron to direct the immediate area, yet gives her a chance to see the entire dressing area. The matron's room should be located close to the entrance, and planned for eye supervision of the entire area. Built-in cabinets should be provided for storage of towels and clothing, and for necessary cleaning and sanitary supplies. Electrical outlets are needed for a sewing machine and for an iron (minor repairs of departmental materials). If possible, a small closet should be provided for the personal use of matrons (coats, purses, etc.). Custodial closets with a sink and the racks needed for brushes, mops, and rubber hose should be provided.

This room should be equipped with a telephone so that emergencies may be reported at once. A buzzer system to summon the matron when workmen need to enter the dressing-shower area is also a necessity.

The size of the matron's room depends upon the size of the dressing-shower area and the number of matrons using it. Usually 70 to 80 square feet is sufficient for one matron serving sports and dance areas. When the matron services a swimming-pool dressing room, additional space is required for the larger number of towels in use.

CUSTODIAL QUARTERS

Well-planned quarters for custodial staff encourage systematic management and routine, efficient, and economical use of supplies and tools, and, most important, a high standard of workmanship. The standards of housekeeping and maintenance must be high to do an effective job of teaching the observance of good health and safety habits. The custodial superintendent should assist in the planning of these facilities.

Custodians' closets should be planned in relation to the equipment and materials to be used. For example, closets near large general-use areas should be large enough to accommodate the equipment needed for maintenance purposes. At least one fire-resistant closet should be provided for each 7,500 to 10,000 square feet.

Within the custodial closets, there should be a floor sink, open shelving for paper supplies and cleaning materials, and a built-in rack for brushes and mops. Space is also needed for the storage of vacuum cleaners, floor waxers, and other large equipment items for cleaning.

It is recommended that, if possible, a custodial workshop be provided for minor sports equipment repairs and maintenance functions. Counter space is needed for work on such items as balls, archery arrows and fencing foils. A cabinet for small tools, and a slop sink for washing equipment are needed. Good lighting, ventilation, and electrical outlets for tools should be included. It is recommended that a room of 150 to 160 square feet be provided.

TRAINING AND FIRST-AID ROOMS

The athletic training room should be a functional facility where the physician and athletic trainer can provide efficient service to students and athletes. Although the primary function of this room is its use for the prevention, first aid, and care of athletic injuries, it can also serve other purposes:

- As a first-aid room for the various college and community functions
- As a classroom laboratory for classes in first aid and athletic training

Since the trainer often assumes the responsibility for the care of athletic injuries in physical education, and in inter-collegiate and intramural sports, he should be involved in the planning of the training and first-aid room. The training-room facilities should be coordinated with those in the physical therapy department in the student health center when such facilities are available. Since the college physician supervises both facilities and the attendant personnel, such coordination is essential. Such coordination may also serve to reduce the amount of expensive therapeutic equipment needed for the institution.

LOCATION

The training-room facilities should be located next to the dressing quarters for athletic teams, whether in the field house or gymnasium. If the physical plant is so designed as to allow all athletic activities, indoor and outdoor, to flow out of one large central facility, one centrally-located training room is recommended. Such a facility is shown in Figure 31.

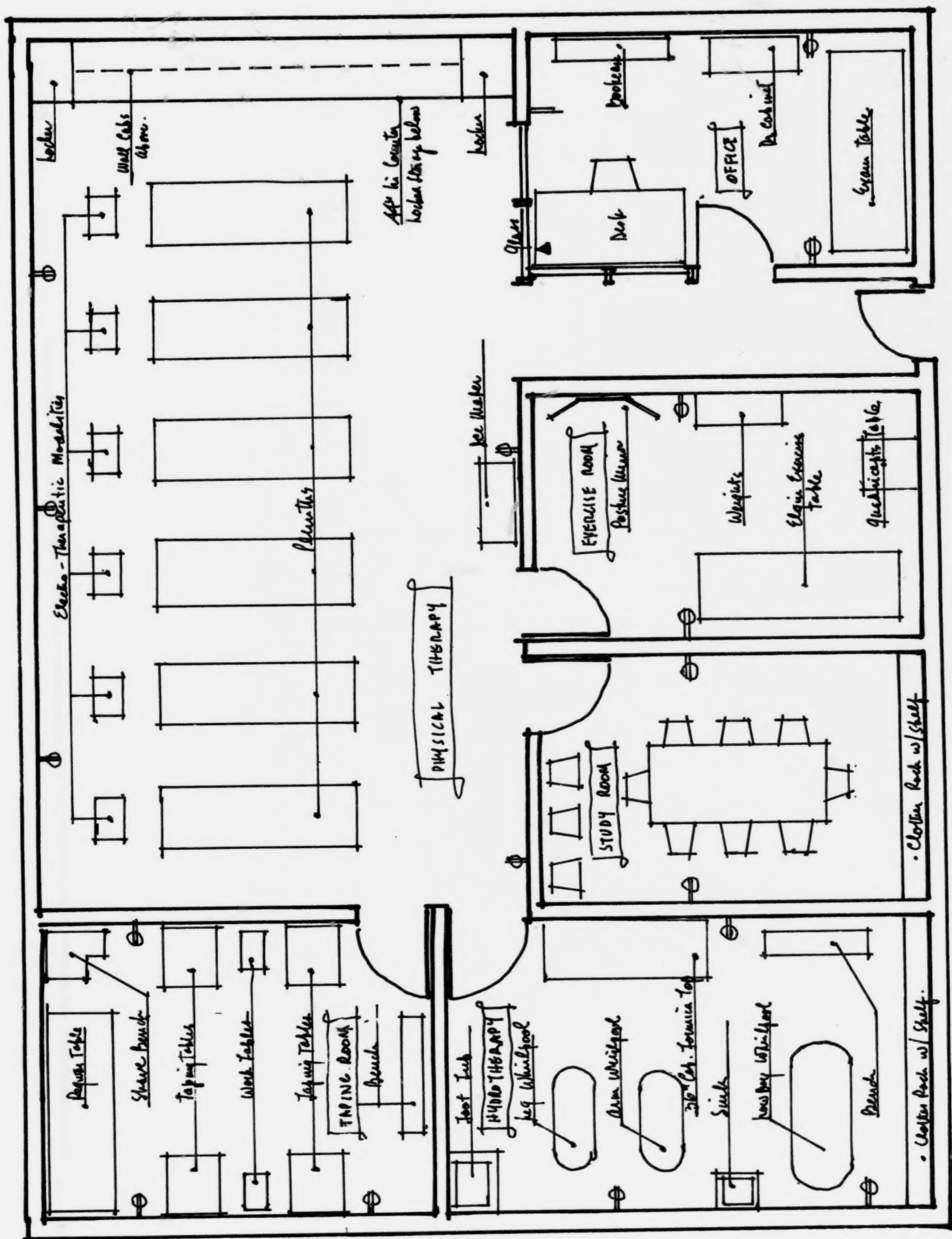


Figure 31
Central Training Area

When the physical plant is spread out so that one training room cannot serve all playing areas, smaller auxiliary training rooms should be provided for the necessary pre-practice and pregame adhesive strappings (see Figure 32).

The training room should be remote from the laundry and shower rooms. The room should be planned as a cul-de-sac in order to avoid traffic through the area. Since ambulance services are required, adequate doors and corridors to the area should be provided.

LAYOUT

The athletic training room should be designed to meet future as well as present needs. The number of students on the campus, the extent of competition in the intercollegiate and intramural athletic programs, and the number of participants in the physical education program will affect the size and make-up of the training room.

The room should be divided into several work areas. The following areas are commonly used: (1) hydrotherapy area; (2) electrotherapy area; (3) general first-aid and tap-

ing area; (4) medical and trainers' offices; (5) exercise area; and (6) storage area.

The size will vary with the number of students to be treated at one time. The room should be large enough to accommodate 12 to 15 students without crowding. A central training room should be at least 1,000 square feet in size. A minimum of 3 feet of unobstructed working space should be provided around plinths, cabinets, and apparatus. Aisles for channeling traffic within the room should be at least 5 feet in width.

The area should be constructed so that all parts of the room are easily seen from any point within the room. When partitions are used to separate work areas, windows should provide an unobstructed view.

The materials used in the construction of the training room should be safe, durable, attractive, and easy to maintain. Floors and walls should be of tile or similar material. The wiring should be adequate, and all power equipment should be properly grounded. Ventilation and lighting standards are covered in Chapter 4.

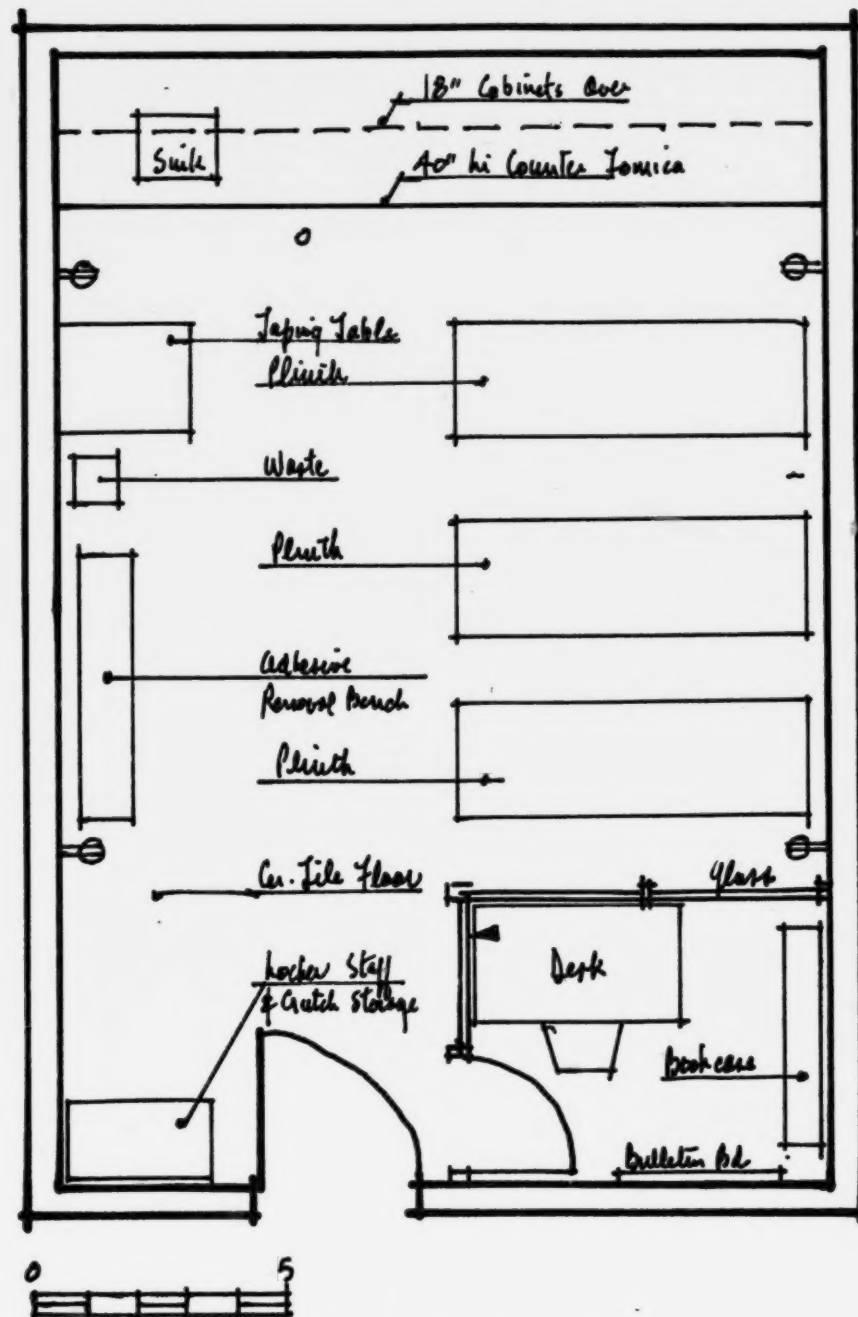


Figure 32
Auxiliary Training Room

SERVICE AREAS

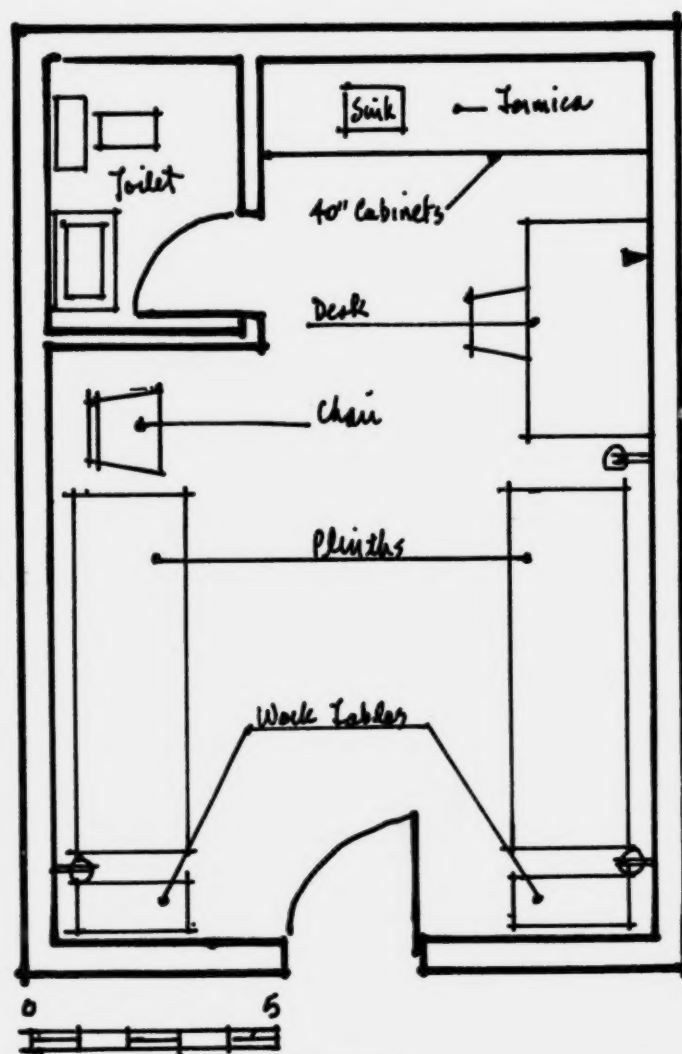


Figure 33
First-Aid Room

The plumbing needs will be determined by the equipment selected. However, special care should be taken to ensure adequate drainage in hydrotherapy areas.

An ample supply of both hot and cold water is needed in this room at all times. A wide variation in water temperature is necessary for the proper operation of hydrotherapy equipment and for maintenance requirements.

GENERAL FIRST-AID AND TAPING AREA

This area is the "key" in the overall plan of the athletic-training facility. Activity here will consist of emergency first aid and the preparation of athletes for participation. From this location, individuals requiring additional care will be directed to other treatment areas. Where a large central facility is provided, the taping room should contain at least four tables (see Figure 31).

ELECTROTHERAPY AREA

The electrotherapy area should contain a minimum of

six treatment plinths, padded with leatherette. They should be constructed of wood and should be heavily braced. Electrical outlets should be located at the head of every table, 4 feet from the floor. All electric circuits should be adequately grounded.

HYDROTHERAPY AREA

Individual whirlpools are recommended for the hydrotherapy area in preference to the "gang" type. Room finishes should be the same as for shower rooms. This room is self-contained but must be an integral part of the total facility for efficiency and proper supervision.

The hydrotherapy area may be separated from the other training areas by a raised curb and a glass partition 3 feet high. Three whirlpool baths, a hand sink, and a foot tub are located in this area. Adequate drainage should be provided.

OFFICE

The trainer's office should be separated from the rest of the training-room suite by a glass partition, and should be so located that supervision of the activity of the entire suite is easily possible. A storage room should be provided for supplies and therapeutic agents.

VISITING-TEAM TRAINING ROOM

The visiting-team training room should be located adjacent to the visiting-team dressing room, or partitioned from the visiting-team dressing room proper. This training room should be large enough to accommodate two plinths, two work tables, a bench, and a sink. It is not necessary to include storage cabinets for a visiting athletic trainer because he would normally carry with him all athletic medical supplies needed. A telephone outlet is recommended.

SAUNA BATHS

The sauna bath is a natural complement to the training activities. The room should be located adjacent to locker and shower rooms for ease of supervision and use. When the number of people to be serviced is determined, sauna-bath manufacturers should be consulted as to the size needed. These manufacturers will also supply standard details for incorporation into the facility plans for a particular institution.

FIRST-AID ROOMS

A first-aid room should be located as near as possible to audience seating. Easy access to a loading dock for an ambulance should be provided. The storage cabinet should contain an adequate first-aid kit, resuscitation equipment, including emergency oxygen, and a set of pneumatic air splints. A telephone and cot should also be provided. A suggested layout is shown in Figure 33.

SELECTED REFERENCES

California State Department of Education, *Planning of Shower, Locker, and Dressing Facilities for California Schools*. Sacramento: State Department of Education, Bulletin No. 53, November, 1956.

Crawford, Wayne H., *A Guide for Planning Indoor Facilities for College Physical Education*. New York: Bureau of Publications, Teachers College, Columbia University, 1963.

"Focus on Facilities," *Journal of Health, Physical Education, and Recreation*, April 1962, pp. 33-48.

Gabrielsen, M. A., and Miles, C. M. **Sports and Recreation Facilities for School and Community.** Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1958.

Herrick, J. H.; McLeary, R. D.; Clapp, W. F.; and Bogner, W. F., **From School Program to School Plant.** New York: Henry Holt and Co., 1956.

New York State Education Department, **Planning the Indoor Physical Education Facilities.** Albany: State Education Department, 1962.

Scott, Harry A., and Westkaemper, Richard B., **From Program to Facilities in Physical Education.** New York: Harper and Brothers, 1958.

Sleeper, Harold R., **Building Planning and Design Standards for Architects, Engineers, Designers, Consultants, Building Committees, Craftsmen, and Students.** New York: John Wiley and Sons, Inc., 1955.

Sumption, Merle R., and Laudes, Jack L., **Planning Functional School Buildings.** New York: Harper and Brothers, 1957.

Chapter 10

CLASSROOMS, LABORATORIES, AND RELATED INSTRUCTIONAL AREAS

Classrooms sufficient in number, size, and purpose are essential to physical, health, and recreation education programs. The classroom complex will depend upon projected enrollments and breadth of curriculums.

The professional courses in health education, physical education, and recreation will normally include: sessions utilizing audiovisual aids; lectures in the foundations of these fields; basic knowledge lectures in such areas as applied physiology, kinesiology, anthropometry, and health instruction; and basic instruction in a variety of skills. In many instances, experiences in the applied physiology laboratory supplement the skill and lecture periods, so location and traffic patterns for both sexes become prime considerations.

Space for health education, physical education, and recreation classes meeting at any one peak-load hour poses serious problems. Inclement-weather adjustments requiring a transfer from outdoor facilities to indoor classrooms make it necessary to have reserve classroom space which is both adequate and flexible. Movable partitions can be used advantageously for the control of seating capacity and the combining of several sections into one large class. At least one large amphitheater-type auditorium room is also needed. These rooms should be adequate for combined sections, large classes, and clinics ranging in seating capacity from 150 to 300 persons.

The space requirement for instructional areas varies from 12 to 20 square feet per student, depending upon function and size, with the larger room requiring less space per student. The standard classroom should accommodate seating for approximately 40 students. The above standards apply to general-purpose classrooms only. Auxiliary areas (e.g., storage space), special equipment (e.g., chalkboards and audiovisual aids), or specialized-instruction requirements (e.g., demonstration space) may change the requirements. An additional 20 percent may be allowed for these special needs or for multiple use of classrooms.

The professional courses in health, physical, and recreation education should have classrooms and auxiliary areas planned for lectures, discussions, or demonstrations. These facilities should be planned in accordance with the best accepted standards.

Common conveniences and special features, such as the protected wall clock, lighting, acoustical treatment, thermostatically-controlled mechanical ventilation, chalkboards, stationary tackboards, electrical outlets, and connections for radio and television, should be included and strategically located. Modern construction should provide the necessary television conduits and the basic equipment essential for future installation of air-conditioning, even though construction budgets may prevent initial installation.

Lighting glare should be avoided. Interior decorating

is also an important consideration. Although the newer audiovisual projectors and screens do not require completely-darkened rooms as in the past, some effective and easily-operable room-darkening method should be installed. (See Chapter 4 for detailed standards.)

Movable lab desk armchairs, straight chairs with conference tables, or fixed chairs should be provided according to the functional use of the space. Generally, large lecture halls and auditoriums are equipped with chairs permanently secured to the floor and ramped for good sight lines.

Storage spaces for apparatus and instructional materials, display racks for periodicals, and other needs as dictated by the courses involved should be listed for inclusion. Where needs are extensive, the 20 percent additional square footage may be used as a guide.

HEALTH AND SAFETY CLASSROOMS

Instructional facilities for health and safety should include not only the space allotments and conveniences of the standard classroom, but also the special features essential to health and safety instruction (see Chapter 11).

SEMINAR ROOMS

Small functional seminar rooms that will seat 15 to 25 persons for small meetings and round-table discussions should be planned. The minimal required space for such rooms is 15 to 20 square feet per student. The rooms should be located in the proximity of laboratories and other instructional units so that they may be used to the maximum.

Some plans may include double or large-size offices containing 240 to 300 square feet. This space may then be utilized jointly for office space and seminar rooms.

TEACHING MATERIALS CENTER

Curriculum laboratories and teaching resource-materials centers need flow patterns and security controls similar to a library. Display racks, counters, and tables should be spaced to facilitate their use. Lighting, ventilation, and other services should be planned to meet the peak loads (see Chapter 4).

A teaching materials center may serve as a part of the departmental, division, or school library.

In laboratory-type rooms, the space needed per student ranges from 13 to 95 square feet. With additional allocations of up to 20 percent for the display and stack areas, the teaching materials center will normally require 35 to 50 square feet per student.

ELEMENTARY PHYSICAL EDUCATION INSTRUCTIONAL LABORATORIES

In the professional preparation of physical education teachers and elementary school teachers and administrators, increased emphasis is being placed on the program of physical education at the elementary level.

Not only should physical educators know and understand the facilities needed for elementary programs, but classroom teachers and elementary school principals should have an opportunity to study elementary physical education in its proper environment. This environment includes indoor and outdoor instructional laboratories designed and equipped for children.

INDOOR LABORATORY

A gymnasium designed to house the elementary physical education professional preparation program is desirable. The following guide lines are recommended:

- Dimensions of 54' x 76'
- Minimum ceiling height of 18 feet
- Maximum ceiling height of 24 feet
- Tongue-and-groove select maple flooring (Consideration should be given to new-type, resilient synthetic materials.)
- Markings should be painted on the floor before completing the final finish coat (This procedure preserves floor markings for many years.)
- Steel girder beams extending widthwise in this facility should permit installation of overhead apparatus such as:
 - 4 climbing ropes
 - 4 climbing poles
 - 4 pairs of wall adjustable flying rings
- Wall construction should allow installation of the following:
 - One adjustable horizontal ladder
 - Stall bars
 - Eye hooks for net mountings
 - Basketball goals
 - A wall-mounted chalkboard, tackboards, and hook strips
- Walls should be painted a light, aesthetically-pleasing color

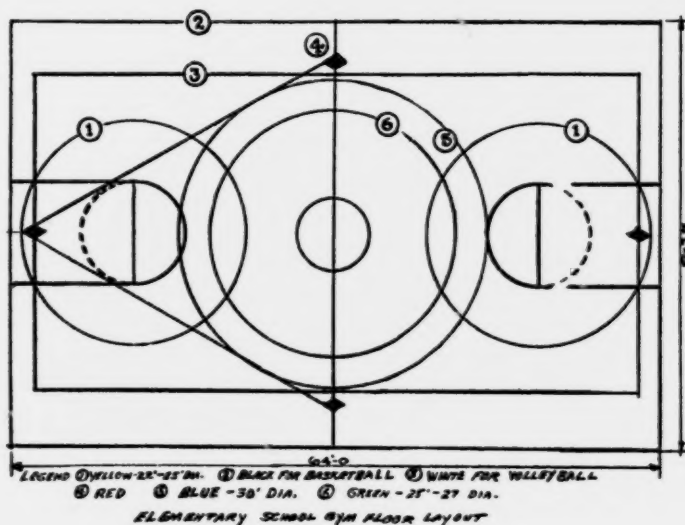


Figure 34
Elementary School Gym Floor Layout

- Lighting units should be protected by guards or transparent, nonbreakable plastic coverings
- Duplex electrical outlets should be located approximately 12 inches from the floor on at least one sidewall and one end wall
- There should be an even distribution of light through the room

OUTDOOR LABORATORY

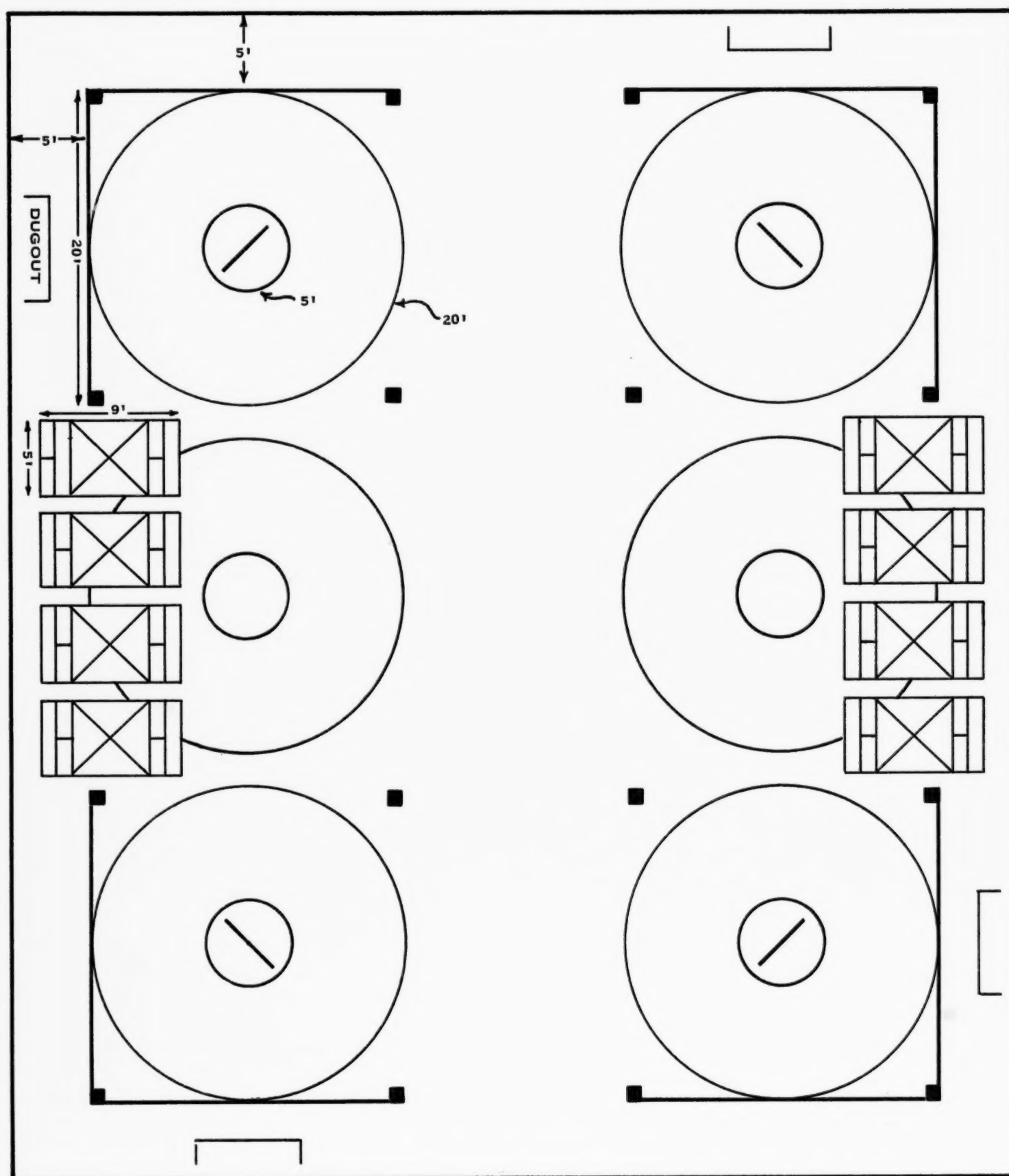
The following recommendations should be helpful in planning the instructional laboratory for elementary school physical education course work for elementary physical educators, classroom teachers, and elementary school principals:

- Minimum dimensions of 130' x 180' asphalt area or resilient synthetic material¹
- Minimum dimensions of 150' x 200' turf area¹
- Asphalt or new synthetic-type area should have a smooth surface with line markings, including circles, diamonds, running lines, 4-square, and hopscotch
- Turf area should have close-cut grass
- If located next to laboratory school, asphalt areas should be distributed around the building according to locations of the kindergarten, primary, and intermediate levels (Strategic placing of the asphalt areas reduces traffic through the building and through other group areas.)
- Class organization and care of the area may be more logically planned if the turf area is in one location
- A chain-link galvanized fence should separate all playground areas from street and sidewalk traffic
- Openings to the outside area from the playground should be of the baffled type, constructed of chain-link fences
- Permanent apparatus should be strategically placed on the hard-surface areas according to kindergarten, primary, and intermediate levels
- Permanent installations of apparatus should include:
 - Climbing tower 6' long x 6' wide x 7-1/2' high
 - Junior horizontal ladder, crossbars 3-1/2', 4-1/2', and 5-1/2' above ground
 - Junior horizontal ladder 12' long, with gradual slope from 6' to 5'
 - Senior horizontal bars 16' long, with gradual slope from 7-1/2' to 6-1/2'
 - Apparatus obstacle course
 - Sculptured play apparatus
- Placing a resilient synthetic surfacing material under all apparatus has merit
- Both asphalt and turf areas should allow space for children to play creatively with boxes, benches, balance beams, and cylinder-type equipment for climbing over, through, and under

DEPARTMENTAL LIBRARIES

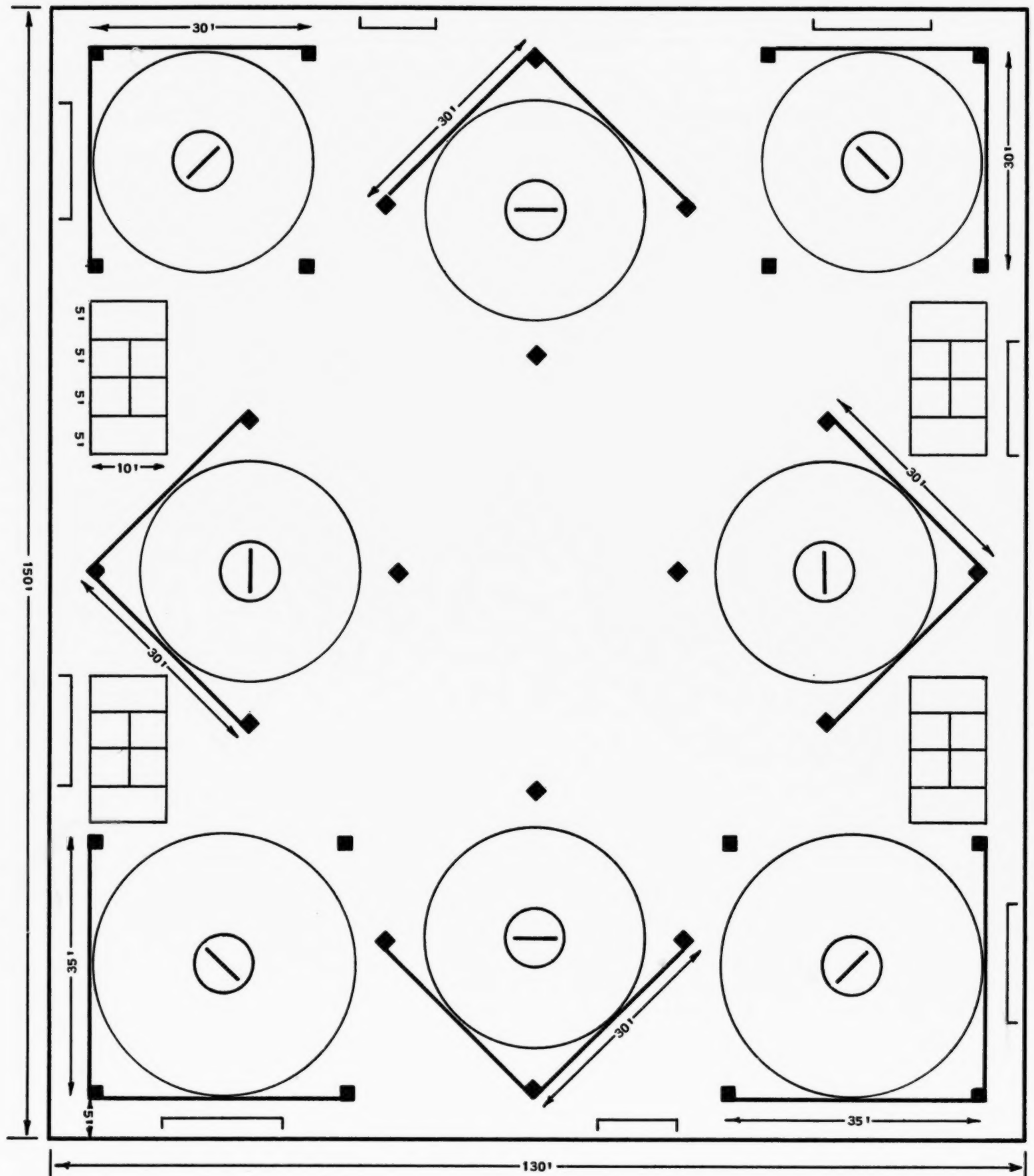
Basic philosophy concerning departmental or central branch libraries must be established before extensive planning can be done. Departmental or branch libraries should provide for adequate shelf space. Reading rooms, carrels, and functional zones should be carefully planned. Librarians who know and understand the problems should assist in checking plans for space requirements, traffic flow, control, and storage space. The common guides used to indicate space requirements specify 30 to 35 square feet per reader station, and 8 volumes to one linear foot of stack area.

¹ Based on school enrollment of approximately 500 students.



Scale: 1" = 10'

Figure 35
Suggested Playground Markings for an Asphalt Area
Kindergarten - Primary Grades



Scale: 1/2" = 10'

Figure 36
Suggested Playground Markings for an Asphalt Area
Lower and Upper Intermediate Grades

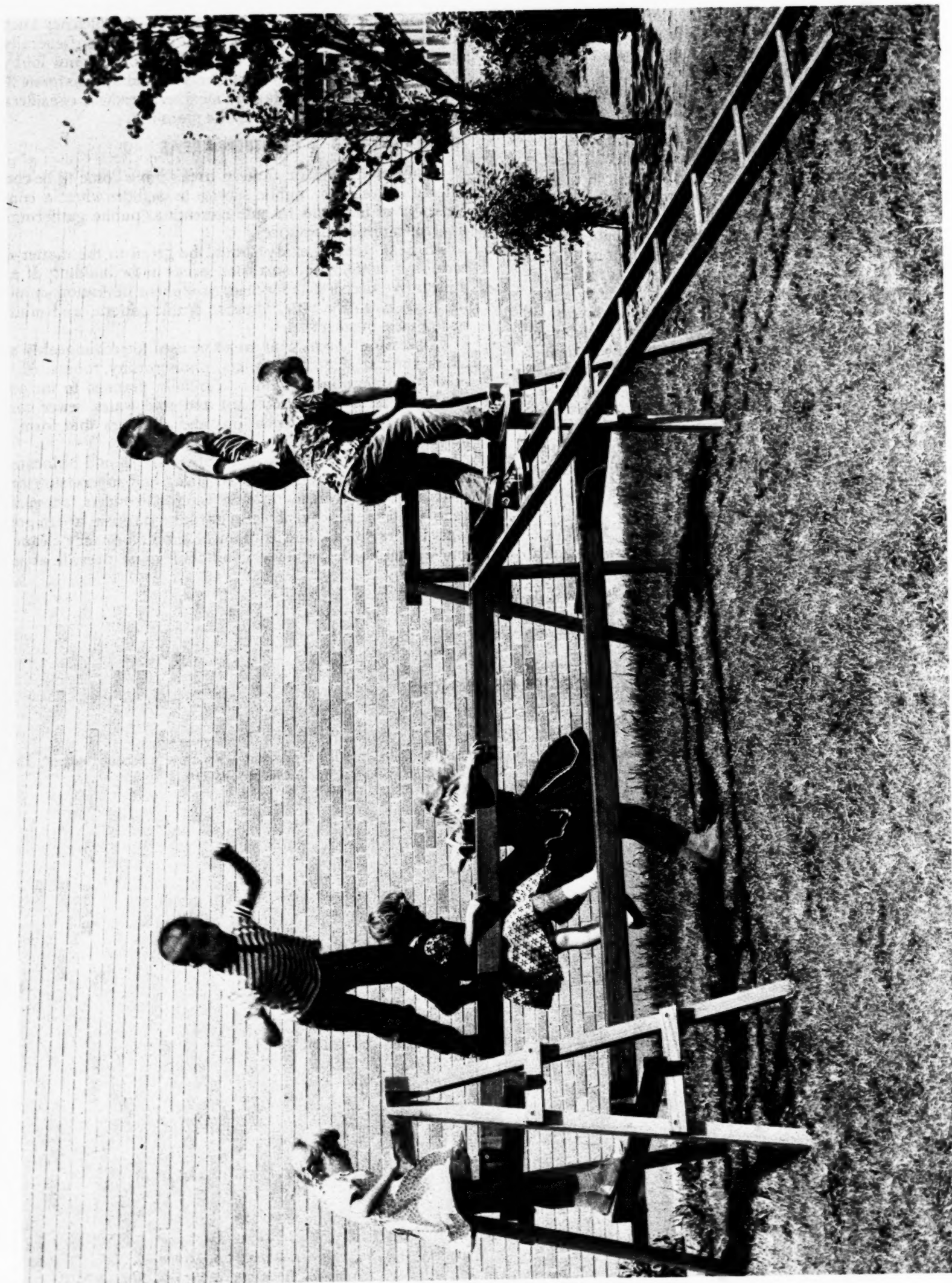


Figure 37
Elementary Physical Education Instructional Laboratory, Northern Illinois University

With the computerized retrieval systems developing, adequate provisions should be made for the inclusion of the necessary conduits and space in the library. Where departmental libraries and teaching materials centers are combined in a complex of rooms, or space is limited, some thought might be given to combining a student reading room (lounge) with limited library resources.

STUDENT READING ROOMS (LOUNGES)

There is a need for reading and study rooms in a modern physical education building. These rooms may serve a variety of educational needs which conserve time and encourage reading and study. Even where stringent economy must be practiced, there are several combinations of uses that justify the need. Students who have free hours between activity or professional classes may go in uniform to study. These rooms may also function as club rooms for major students, lettermen's rooms for varsity athletes, and departmental or student libraries. An efficiency kitchenette, including refrigeration and cooking units, could be incorporated as an adjacent or joint unit.

Standards for space requirements should approximate 30 to 35 square feet per student at peak load. The location of the rooms should be governed by their function. Aesthetic and functional accommodations should be carefully planned so the rooms will be fully utilized.

FACULTY LOUNGE(S)

Provision for a faculty lounge is desirable from several standpoints. There is a need for a general meeting room for

faculty gatherings, entertainment of special guests, and relaxation after strenuous activity classes. An efficiency kitchenette should be included as an adjacent unit. Generally, these rooms should be close to the central offices and lobby.

Standards for space requirements should approximate 20 square feet per full-time faculty member. Aesthetic considerations should be emphasized in the planning.

CANTEEN AREAS

Concessions and/or canteen areas have come to be considered a necessary public service in facilities where a combination of functions include recreation, public gatherings, and educational enterprises.

A great deal of study should be given to the matter of including canteen or concession areas in the building. If an affirmative decision is reached, careful consideration should be given as to the type, number, traffic pattern, and multi- or joint use of such areas.

Concession rooms that are to be used interchangeably as cloak rooms, projection rooms, photography rooms, or in other combinations should be carefully planned to include adequate fixtures for sinks, hot and cold water, sewer connections, electricity, ventilation, and counters that form a flush wall when closed.

Canteen rooms that are used constantly should be located near the traffic flow. Ease in servicing and supervision are also important considerations. Electrical outlets, adequate ventilation, and provision for garbage disposal are important. Floors, walls, and equipment should be easily cleaned and maintained. Sanitary conditions must prevail at all times.

SELECTED REFERENCES

American School and University, *Annual*. New York: Bittenheim Publishing Corporation. (Yearly)

Crawford, Wayne H., *A Guide for Planning Indoor Facilities for College Physical Education*. New York: Bureau of Publications, Teachers College, Columbia University, 1963.

Caudill, William, "What Works and What Fails in School Design?", *The Nation's Schools*, March 1967, pp. 85-116.

Chapter 11

HEALTH AND SAFETY EDUCATION FACILITIES

The college or university health and safety education program, like the program at the other school levels, is comprised of three phases: (1) healthful living; (2) health and safety education; and (3) health services. The American College Health Association has prepared a set of "Recommended Standards and Practices for a College Health Program," which may be used as a guide for developing health and safety education programs for colleges and universities.

The purposes and objectives of the health and safety education program can be met only when facilities are provided to conduct the activities designed to accomplish these goals. This chapter attempts to define and point up facility needs related to the college or university health and safety education program in the light of the institution's responsibility to the student, to the community, and to society.

Intelligent self-direction of health behavior is recognized as being an aim of health education which can be achieved through education. The very nature of the institution dictates that education is the basic objective of the college or university program and the primary objective of all three interrelated phases of the health and safety education program—healthful living, health instruction, and health services.

It is important to be aware of the fact that health and safety education takes place in many situations and experiences. Many of the most significant educational experiences occur outside the classroom. With this in mind, it is important that the health and safety education of the college or university, and the facilities for this program, be planned with education as a prominent goal.

While the guide lines suggested here are directed at the provision of facilities for health and safety education, it should be recognized that such provision does not assure wise use. Coordination resulting in effective utilization of facilities can be brought about only by a conscious effort. The health coordinator serves to effectuate cooperative planning and use of these facilities. The health committee, with special responsibilities for the program within the college, can do much to promote essential coordination of the program.

In suggesting guide lines for facilities for the health and safety education program, it is recognized that no single set of standards can be universally adopted. Insofar as possible, the recommendations included herein will provide statements of principles which will underlie any set of standards. Varying needs and philosophies will determine the details of specific requirements for the particular institution.

HEALTHFUL LIVING

The healthful-living considerations in the college or university are directly related to the size and type of institution, the services provided, and the facilities available. Although varying in magnitude and complexity, the college or university environmental-health program embodies the same

general considerations as other institutions providing similar services. When housing and food service are provided, special attention must be given to the healthful-living aspects of the facilities involved in providing these services, and complete compliance with the highest standards of health and safety should be required.

The term "healthful living" embraces all efforts to provide facilities and conditions at the college or university which are beneficial to the health and safety of students and other personnel. Providing an environment conducive to healthful living is a legal and moral responsibility of the institution.

Those responsible for planning the educational program as well as the physical plant should place great importance upon the environmental factors to which students are exposed. Environmental factors make lasting impressions upon the individual. Careful attention to the problems of environmental sanitation, proper lighting and room color, climate control, safety, and construction that lends itself to good housekeeping procedures makes a twofold contribution to the well-being of the student. First, it has the immediate effect of protecting against disease and injury, and promoting and maintaining good health. Second, contact with a healthful and safe environment is an educational experience. In addition, the college or university may help meet its obligation to the disabled through wise planning and construction which eliminates architectural barriers and makes facilities available to all persons (see Appendix G).

A healthful environment is important to the entire college or university and should be planned at the administrative level rather than be restricted specifically to any one program area. Decisions, supported by the advice of the program faculty, must be made by administrators, architects, official agencies, and planning experts in conformance with existing construction standards, codes, rules, and regulations.

HEALTH SERVICES

The college or university health-service program will vary with the size and type of institution, ranging from small units with few demands, which can be met on a first-aid basis, to the large, comprehensive student health center providing services on a par, in both quantity and quality, with many hospitals. The diversity of facilities needed dictates that planning must be done in light of the immediate situation, and that it must involve those who will use the facility, in cooperation with technical and professional planners. The "Recommended Standards and Practices for a College Health Program" of the American College Health Association provide excellent guide lines and references pertaining to college health-service facilities.

HEALTH AND SAFETY INSTRUCTION

The purpose of general health and safety instruction is to provide information and experiences which will lead to

the establishment of attitudes and practices conducive to the conservation, protection, and promotion of individual, community, and world health.

Health and safety instruction facilities in colleges and universities must be suited to meeting the health and safety instruction needs of three groups of students: (1) general health and safety instruction for all students (general education); (2) health and safety instruction for elementary school teachers and others who are not specialists in health and safety education; and (3) health and safety instruction for specialists in health and safety education (health educators and safety educators) who have special responsibilities for providing instruction in these areas.

In meeting the health and safety instruction needs of all students (general education), the facilities required will be comparable in nature and scope to those in the secondary school.

In providing the special professional preparation in health and safety education for teachers, attention should be given to special knowledge and the methodology important to teachers. This will dictate that teachers become acquainted with content, methods, equipment, and facilities, thus emphasizing the need to make the health and safety education program for teachers an exemplary one.

GENERAL FACILITIES FOR HEALTH AND SAFETY INSTRUCTION

The basic space allotment for health and safety instruction facilities in the college or university should be in harmony with generally-accepted standards for classroom size. However, due to the nature of activities involved in health and safety instructional programs, it is recommended that the space allowed for such instruction be increased approximately 35 percent above requirements for the regular classroom. This will result in a space allotment of approximately 1200 sq. ft., including storage space, in the room intended to serve a maximum of 30 students.

The space allotment should be sufficient to allow for such activities as vision and hearing screening, first-aid and safety instruction, and practical demonstrations, and for flexible teacher location. In addition to the conventional teacher's desk, provision should be made for laboratory demonstrations. This indicates the need for a laboratory-demonstration desk which will provide space and facilities for demonstrations. Thus, provisions should be made for water, gas, and electricity, as well as storage space for heating devices, test tubes, flasks, beakers, and other equipment essential to such demonstrations. The diversity of teaching procedures

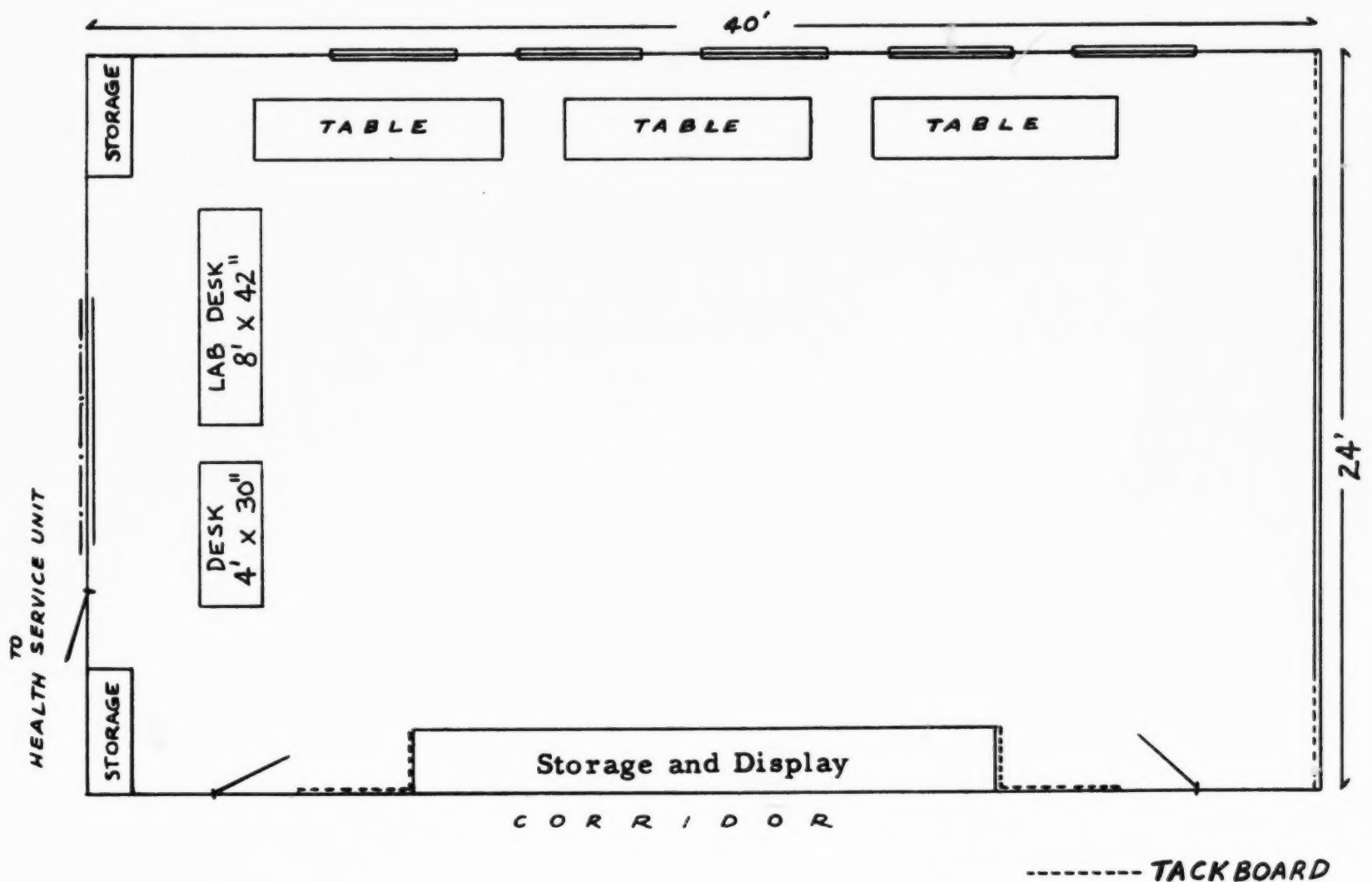


Figure 38
Health and Safety Instruction Laboratory

requires that regular classroom arrangements be used at some times, but at other times floor space be available for practical instruction, such as practice in artificial respiration, splinting, and emergency transportation.

The suggested laboratory method of teaching will require adequate storage space as well as display areas for charts, mannequins, models, and equipment. First-aid equipment, such as blankets, bandages, splints, and stretchers, will also be needed. For instruction in home nursing, such equipment as incubators, roll-away beds, pans, containers, and bedding will be required.

There should be a large amount of display space for the great variety of educational exhibits, literature, and student projects inherent in the health education program. This can be provided by allowing liberal space for tables and shelves, and by using all available wall space for bulletin boards and tackboards. There should be ready access to the teaching materials center (see Chapter 10).

The health and safety instruction laboratory should provide for the optimum use of such additional audiovisual devices as still pictures, slides, motion pictures, radio, and television. This will necessitate a liberal allowance of appropriately-located electrical outlets, shades or curtains which will reduce the outside light, and a screen which may be mounted above the chalkboard behind the laboratory desk.

Special consideration should be given to the provision of a health museum. Such a facility may consist of a separate room, or rooms, where elaborate health and safety exhibits may be on display, or it may be a portion of the health and safety instruction laboratory where exhibits may be on display for a limited time.

The health and safety instruction laboratory should be an example of the ideal classroom environment, with special concern for color of walls, lighting, ventilation, temperature and humidity control, order, and cleanliness. Figure 38 illustrates a suggested floor plan for the health and safety instruction laboratory intended to accommodate a maximum of thirty students.

Safety education must be structured into the program. A good safety education program does not restrict activities, nor does it protect at the expense of education. It does identify hazardous physical conditions and unsafe practices. The hazards should be corrected or eliminated. All activities and student participation should be studied to determine the nature and extent of safety education and supervision required to develop needed knowledge, skills, and attitudes.

Special facilities and equipment are not always required to teach safe procedures and practices. It is important that equipment for physical education and athletics be selected, purchased, and maintained from the point of view of accident prevention. The use of such equipment should incorporate a deliberate intent to provide instruction in safe practices.

INSTRUCTIONAL FACILITIES FOR PREPARING HEALTH AND SAFETY EDUCATORS

In view of the fact that elementary teachers have a good background in educational methods, one of the most important considerations in health and safety preparation would seem to be basic scientific information. The elementary school classroom is generally satisfactory for health and safety instruction, hence the preparation needed by elementary school teachers does not require facilities which differ markedly from those necessary for preparing health and safety education specialists.

Since the facilities for health and safety instruction in the secondary school are comparable to those in the college or university, the general health and safety instruction laboratory provides a most favorable setting for instruction of the specialist. The chief difference between the two settings should be in the diversity of equipment and supplies needed in the professional preparation of the specialist. This diversity is necessary in order to acquaint the prospective specialist with different methods, equipment, and supplies. For example, it may be sufficient to rely on one vision-screening procedure in the general education program at any grade level, but the prospective specialist should be acquainted with several.

RESEARCH FACILITIES

The importance of research in health and safety education should be stressed. Special laboratory facilities are needed in order to conduct the various kinds of research which are essential. Research facilities for health and safety education are described in Chapter 13.

CHECK LIST FOR HEALTH AND SAFETY INSTRUCTION FACILITIES

- Space of 1,200 square feet to accommodate a maximum of 30 pupils
- Flexible teacher location
- Provision for various teaching methods, including laboratory demonstration
- Flexibility of seating
- Hot and cold running water and gas outlet
- Educational-exhibit space
- Storage space
- Provision for using audiovisual devices (electrical outlets, window shades, screens)
- Exemplary environmental features such as lighting, heating, ventilation, and cleanliness
- Adequate hand-washing facilities, drinking fountains, and toilets
- Air-conditioning
- Accessible to and usable by the disabled (see Appendix G)
- Planned jointly for community use

DRIVER EDUCATION AREAS AND FACILITIES

The college or university driver education program is concerned with the preparation of teachers rather than the preparation of new drivers. Prospective teachers should be taught to use and evaluate all available facilities, equipment, and devices for driver education. Facilities, equipment, and devices for the college or university program should, therefore, be similar to those recommended for high schools, but with emphasis on a wide variety of makes and models.

The program of driver education is generally accepted as a responsibility of the school, and, more specifically, as a function of health and safety and physical education departments. The guide lines outlined herein are in keeping with approved standards and national recommendations, both for schools and for the professional preparation of teachers.

INDOOR FACILITIES

For the indoor program of driver education, a classroom, a psychophysical laboratory with testing devices, a simulator laboratory, and an office should be provided.

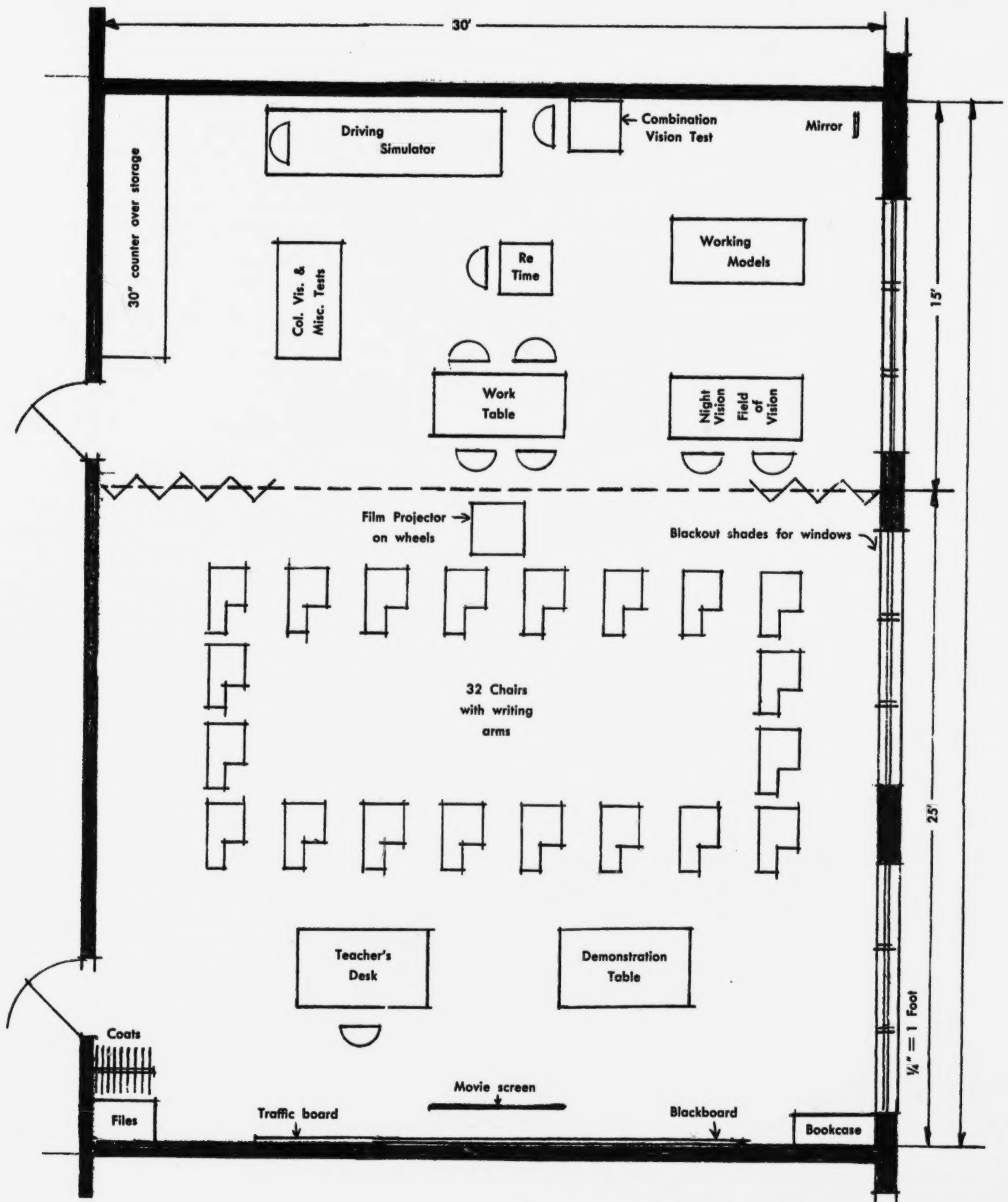


Figure 39
Driver Education Classroom and Laboratory

HEALTH AND SAFETY EDUCATION FACILITIES

All indoor facilities should be on the first floor of the building, near the garage or parking space for the dual-control cars, and near the driving range if one is used.

The recommended procedure is to combine the classroom with the laboratory for a combination room of 1,200 square feet (see Figure 39). Where separate rooms are used, the classroom should be of standard size.

In addition to the standard classroom facilities and equipment, such as chalkboard, bulletin board, desk, and chairs, the driver education classroom should provide facilities for the following special equipment:

- Motion-picture projector
- Bookcases and storage cabinets for such items as films, flip charts, testing equipment, and models
- Demonstration table
- Demonstration equipment, including magnetic traffic board, working models, flannel boards, model signs, and signals

PSYCHOPHYSICAL LABORATORY

The psychophysical laboratory should contain equipment needed to test the student's physical, mental, and emotional qualifications for safe and skillful driving. When the combined room is not used, this laboratory should provide at least 720 square feet of space, with the minimum dimension being 24'.

The furniture and equipment needed in the psychophysical laboratory will include a demonstration table, chairs, and worktables. Spaces should also be provided to accommodate equipment for testing visual acuity, depth perception, color vision, field of vision, reaction time, steadiness, night vision, and the like.

SIMULATOR LABORATORY

Driver education simulators are accepted as a means of providing the preliminary steps to behind-the-wheel instruction. Because of the nature of the simulator units, facilities for them should be considered as permanent installations, preferably in a separate simulator laboratory.

The size of the simulator laboratory will depend on the number of simulator cars to be installed. A typical 8-car installation will accommodate 450 to 500 students per year, and a 16-car installation will accommodate 960 to 1,000. The room size for 8 cars should be 24' x 33'; for 16 cars, it should be 30' x 40'.

Since the college or university program is one of professional preparation, it is often desirable to have a demonstration setting, consisting of a limited number of simulators of different makes rather than a complete instructional layout of any one make.

The room should be clear of obstructions that might interfere with the projector beam, and should be provided with such items as a chalkboard, bulletin board, tackboard, and magnetic board. The cars are arranged in a semi-circular fashion, with the first row a minimum of 8 feet, preferably 10 to 12 feet, from the screen, and with the outside cars not exceeding an angle of 30 degrees from the screen. The first row should have the lesser number of cars.

A minimum of 24 inches should be allowed between the rows, with a 30-inch aisle down each side of the room. Aisle spaces must comply with state safety codes. The projector should be located in the center at the extreme rear of the room, and a 6' x 8' screen should be placed in the front of the room.

Manufacturers' specifications for electrical requirements should be followed. Ordinarily, the standard 110-volt, 60-cycle alternating current is required. It should be supplied

through a double outlet located in the vicinity of the recording unit.

Ample soft white fluorescent-light tubes should be installed to provide 100 footcandles of light at desk height. These tubes should be recessed in the ceiling and should have semitranslucent shields.

Pastel colors should be used. The woodwork and finishing should be compatible with the color used on the walls. A reflection factor of 80 percent is needed for the ceiling, and 60 percent for the walls. The furniture should have a nonglare finish. Heating and ventilation should be in conformance with best accepted standards.

MOBILE LABORATORY UNIT

A mobile laboratory unit may be used when it is necessary to accommodate several locations. Since nearly all mobile classrooms are 12-place units, the size of the trailer should be not less than 52 nor more than 56 feet long inside. The inside height should be 8 feet, with a width of 10'.

The rear of the trailer should contain 2 storage closets, a teacher's desk, a chair, built-in film-storage closets, and program racks. The mobile classroom should have good acoustics, waterproof materials inside and out, high-grade tile on the floor, and windows at evenly-spaced intervals. For maximum safety, two 36-inch doors with safety latches should be located on the curb side. Like any other classroom, the mobile unit should have good lighting, wiring, heating, and cooling systems.

The simulator cars should be arranged six on each side, one behind the other, with the step form of elevation for cars so all students can see the screen.

OUTDOOR AREAS AND FACILITIES

Behind-the-wheel instruction provides the skills necessary for safe and efficient driving. Provision should be made for extensive experience under a wide variety of conditions.

ON-STREET DRIVING

An on-street driving area is recommended where traffic congestion is not a problem. The first driving maneuvers should be conducted in locations such as driveways where there is no traffic. As ability develops, students should get experience driving in situations approximating normal driving conditions, and then, finally, in actual normal traffic situations.

Blocked-off streets are sometimes used when street traffic is too heavy and school driveways are not available to teach the first driving maneuvers. Arrangements should be made with the residents of the area and with police officials. Since advance driving skills are taught where other traffic is involved, streets should not be blocked off for an undue length of time.

OFF-STREET DRIVING

An off-street driving range is recommended where land is available. Ranges should be laid out to simulate most physical situations associated with driving, such as: traffic signs, signals, and other control devices; parallel and angle parking; upgrade and downgrade situations; and simulated emergency situations. Space should allow for needed skill-test maneuvers. Different types of road surfaces should be provided. If night classes are conducted, the area should be lighted. The size of the driving range should be no smaller than 350' x 450'.

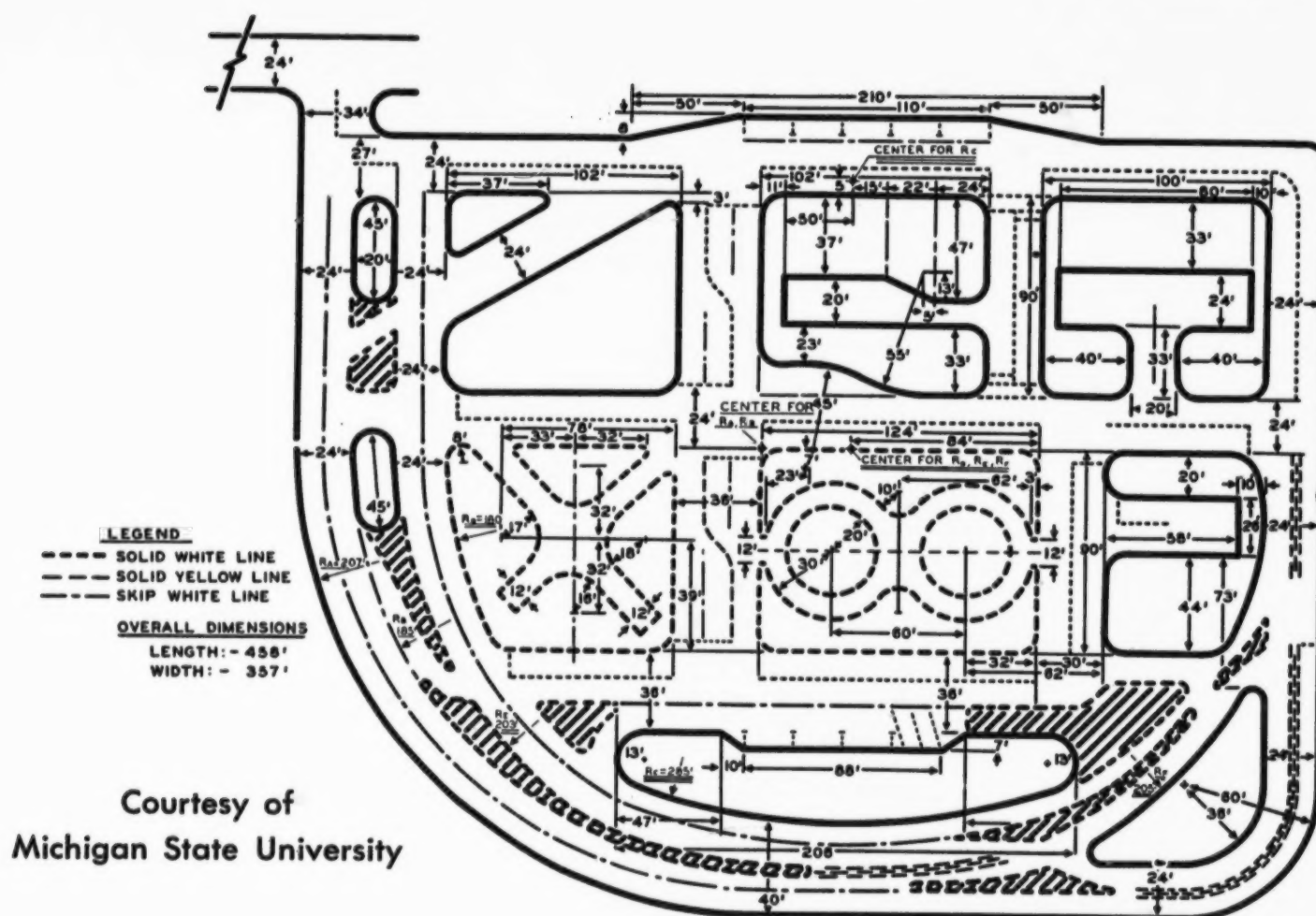


Figure 40
Multiple-Car Off-Street Driving Range

The multiple-car driving range has the advantage of accommodating several cars simultaneously under the supervision of one teacher, thus reducing the per-student cost. With this type of range, communication between the instructor and students is accomplished by means of radio or public-address system.

The following is a list of recommended equipment and facilities for the off-street driving range:

- Curbs for parking practice
- Intersections for various turn maneuvers
- Gravel area for driving and turn maneuvers
- Streets marked properly
- Streets that are both wide and narrow

- All signs—traffic-control signals, stop, warning, yield the right-of-way, regulatory, guide, and information
- Upgrade and downgrade roadways
- Simulated road surfaces—concrete, asphalt, and gravel
- Muddy surface for emergency situations
- Stanchions, guide-on, etc., for maneuvers

POINTS TO REMEMBER

- Determine the needs of the student and the objectives of the program
- Provide as many realistic situations as possible
- Design the driver-training area equal to the best facilities available

SELECTED REFERENCES

Allgaier, Earl, *Classroom and Laboratory Facilities for a Driver Education Course*. Washington, D.C.: Traffic Engineering and Safety Department, May 1964.

American College Health Association, "Recommended Standards and Practices for a College Health Program, Part II," *Journal of the American College Health Association*, October 1963.

Brady, Leon, and Stack, Herbert J., *Highway Safety and Driver Education*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1962.

Joint Committee on Health Problems in Education of the National Education Association and the American Medical Association, *Health Education*. Washington, D.C.: National Education Association, 1961.

Healthful School Living. Washington, D.C.: National Education Association, 1957.

School Health Services. Washington, D.C.: National Education Association, 1964.

Suggested School Health Policies. 5th ed. Washington, D.C.: National Education Association, 1967.

National Commission on Safety Education (NEA), *Driver and Traffic Safety Education: Policies and Practices*. Washington, D.C.: The Commission, 1958.

Participants in National Facilities Conference, *Planning Areas and Facilities for Health, Physical Education, and Recreation*. Chicago: The Athletic Institute, and American Association for Health, Physical Education, and Recreation (NEA), 1965.

Teacher's Manual for Driver Education. Springfield, Ill.: State Department of Public Instruction, 1958.

Chapter 12

OFFICES AND ADMINISTRATIVE UNITS

In planning college and university facilities for health education, physical education, recreation, and athletics, careful consideration should be given to the administrative functions which take place in conducting these programs. Essential facilities related to administration in these program areas include:

- Administrators' offices
- Faculty offices
- Secretarial and clerical offices
- Reception and waiting rooms
- Office staff workrooms
- Student sports activity offices
- Conference rooms (or lounges)
- Staff locker, shower, and rest rooms
- Toilet rooms
- Storage rooms

OFFICES

Though not an infallible standard, examination of contemporary American colleges and universities discloses that there is a ratio of approximately one full-time (or the equivalent) faculty member in health education, physical education, recreation, and athletics for every 275 full-time students, particularly where the traditional required, intramural, intercollegiate athletic, and recreation programs are offered. This ratio would be smaller where graduate programs and research are emphasized, or where professional preparation in health education, physical education, and recreation is a major function.

A large number of the working hours of a faculty member are spent in his office where he can carry on a variety of activities related to his teaching-coaching-administrative functions. Thus, each full-time faculty member should have his own private office. This office should be quiet, attractive, comfortable, and functional. It should provide security, a reasonable amount of storage space, and it should enhance the dignity and efficiency of the occupant.

The individual office should be a minimum of 100 square feet in size. A larger office is an invitation to house more than one in the room, and thus destroy privacy. Careful thought should be given to the location and arrangement of doors, windows, telephone, electrical outlets, intercommunication facilities, storage facilities, lighting, and units for heating, ventilation, and cooling.

Each faculty member's office should provide space and arrangements for the following items:

- A large work desk, with lock
- A comfortable desk chair
- A four-drawer filing cabinet or credenza
- Bookshelving for 200 volumes
- A side chair
- A compact storage cabinet or built-in closet

Air-conditioning is recommended in warmer climates in view of the trend toward year-round operation.

Offices should be located in an area free from general traffic noises. Careful consideration should be given to acoustics, including the transmission of sound through the walls and air-supply system. Without sacrificing privacy,

the faculty member's office should be close to his teaching station and secretarial services. Office carpeting is desirable for good acoustics, decor, and faculty morale.

ADMINISTRATORS' OFFICES

The same elements listed above apply to the office of an administrator. It should be a minimum of 200 square feet in size. It should have easy access to the secretarial area and still have the necessary privacy.

A large facility may contain a suite of offices with accommodations for several administrators. Administrative offices should be provided with private toilet rooms.

FACULTY LOCKER-SHOWER ROOMS

Where the number of faculty members exceeds eight, thought should be given to a faculty locker-shower room. Such an area should contain showers, a toilet, and an individual dressing locker for each faculty member. Comparable facilities should be provided for both men and women.

SECRETARIAL AND CLERICAL OFFICES

Where a college or university operates an extensive program in health education, physical education, recreation, and athletics, one secretary or clerk-typist for each three full-time faculty members is considered minimum. Anticipated growth should be given careful consideration in facility planning.

A centralized "main office" is generally the rule in administrative arrangements. However, in large operations, there is much to be said for dispersing the secretarial and clerical offices according to their functions (e.g., intercollegiate athletics, intramural sports, health education, men's physical education, women's physical education, and recreation). Personnel working in these offices perform, in varying degrees, the following duties:

- Act as receptionists for students, faculty, visitors, salesmen, press representatives, and the like
- Take and transcribe dictation, and perform a variety of typing chores
- Receive and redirect telephone calls
- Receive and distribute mail and other communications
- Answer written correspondence
- Schedule appointments, and, in general, "keep track" of faculty
- Operate a variety of office machines, such as duplicators, mimeograph machines, ditto machines, and computers
- File department papers, correspondence, forms, and other materials
- Transact certain business operations, such as book-keeping and accounting
- Prepare copies of class tests and other teaching materials as needed in courses
- Dispense tickets for spectator events

The secretarial and clerical offices should be reasonably prominent and accessible, but not situated so as to encourage socializing and loitering. They should act as buffer areas for individual faculty members. The combination reception room-office arrangement has much to commend it, but there is some risk that the reception function may make it difficult to carry out the other necessary duties of a secretary or stenographer.

Reception rooms or areas should be large enough to accommodate one caller for each faculty member whom the office serves, but should be a minimum of 200 square feet in size. The reception room should have a dignified and relaxing atmosphere. It should be separated from the office employees by a counter or partition, but be constructed to enable the receptionist to observe those coming into and going from the reception area. The counter can also serve as a worktable over which many transactions between the secretaries and others can take place. Space for such items as chairs, small tables, and a coat rack is necessary in the reception area. Carpeting in this area is conducive to quietness and an air of dignity.

In a larger office, where two or more employees are stationed and the reception function is distracting to employees engaged in other work, it may be desirable to separate the reception area from that used for secretarial or clerical work. In such case, a separate but adjoining office space should be provided for secretarial or clerical employees.

The secretarial office should provide ample space for a work desk, filing cabinets, built-in closets or storage cabinets, a typing station, and a worktable or counter. Secretarial and clerical employees should have operating space of at least 120 square feet per person, exclusive of the reception and storage areas.

The telephone should be located at the receptionist's desk. The combination telephone, with telephone-intercom extension phones to each office, is recommended. Incoming calls should signal only the receptionist. She should receive all calls and route them to the proper person. Faculty offices should be equipped with extension phones providing intercommunication and conference features. All telephones should facilitate privacy and convenience.

Individual mail boxes should be provided for each key person in the building. These boxes should be readily accessible, should be constructed so that mail and messages can be easily placed in them, and should provide the privacy and security normally expected.

WORKROOMS

In smaller administrative suites, a workroom is a necessity. It can house machines, such as duplicators, mimeograph machines, ditto machines, and calculators, and provide space for operating them. Shelving for paper storage, and space for stencil files is desirable. Although the location of the workroom is important, it should not occupy prime space. It should be immediately accessible to the office workers and close to the reception room. A toilet room with one hand lavatory and one water closet should be adjacent to this workroom.

CONFERENCE ROOMS

At least one conference room should be included in the plans for a modern physical plant designed to serve the health and safety education, physical education, recreation, and athletic programs. Such a conference room should provide a minimum of 15 square feet of floor space per occupant under peak-load conditions. This room might also be

used as a staff lounge, a student-faculty meeting room, a reading room, and a film-viewing room. The visual, thermal, and acoustical environment should be balanced. An efficiency kitchenette adjacent to the conference room may be desired. Chapter 10 contains further details on faculty lounges.

STORAGE AREAS

An easily-accessible and secure storage area is desirable in the administrative unit. This area should provide storage for relatively small, but possibly valuable, items of equipment and supplies, such as:

- Films
- Books and periodicals
- Projectors
- Office supplies
- Retainable records and documents

Ideally, this storage area should be located so as to be under the surveillance of the office personnel.

ATHLETIC TICKET OFFICE

If the facility housing administrative personnel also contains spectator facilities, or serves a spectator ticket-dispensing function, this area should be isolated from the other administrative units without losing close communication with them. It is important that the athletic ticket office serve a crowd at a contest expeditiously and, in so doing, not disturb the other administrative facilities and functions in the building. This office can serve effectively as both a working office and a ticket booth.

The ticket office needs to be planned for a continuous advance sale of tickets. Those coming for service should be in easy view of the ticket-office personnel. To provide security for money and tickets, a vault or safe should be built into the facility. Drawers for money should be built into the counter. A glass window wall with speaker openings and curtains which can be drawn for privacy should be provided.

FACILITIES FOR GRADUATE ASSISTANTS

Graduate assistants (or teaching fellows) are becoming more numerous on college and university campuses. It is important that some plans be made for their accommodations. Ideally, each should be provided a study or work cubicle. Privacy and quiet should be prime objectives. The cubicle should be of sufficient size to accommodate a small study desk with drawers and a work chair. If planned carefully, individual cubicles of 50 to 70 square feet per person can provide adequate study and office space. Good lighting, ventilation, and security are factors worthy of consideration in planning. The offices for graduate assistants should be near the faculty offices.

STUDENT ACTIVITY OFFICES

More and more colleges and universities are making provision for such student-directed recreation programs as sports clubs, intramurals, WRA's, and WAA's. If this is a policy, offices within the administrative unit should accommodate these activities.

The size of each office should be a minimum of 100 square feet per function assigned. It should be arranged to house a desk, files, storage, and a telephone.

It should be determined if a regular or a Dutch door will best serve each specific office from a traffic corridor. A workroom for mimeographing, sign making, and similar activities would be desirable.

These student activities may be more properly grouped together and removed from other college administrative activities.

OTHER SUGGESTIONS

The form of administrative units in health and safety education, physical education, athletics, and recreation will vary with the needs of the particular college or university. Some common organizational arrangements which affect the design of facilities in these areas are as follows:

- The administration of intramural athletics can be separated from other traditional administrative units.
- The teacher-education function can be separated into a self-contained administrative unit.
- Intercollegiate athletics, with peculiar and distinct functions, often lends itself to a separate administrative facility.
- Graduate programs in health education, physical education, and recreation can frequently be accommodated

best as a separate administrative unit with a separate facility.

- The nature of men's and women's physical education programs frequently requires separate but coordinated facilities to best achieve their respective purposes.
- Combinations of the above are sometimes feasible and can be grouped in a single facility.

The centralizing of faculty offices may tend to improve morale, communications, and unity of purpose. This may be of more importance than separating faculty members so as to locate them nearer to their teaching stations.

Single offices, even though small, are preferred to shared offices.

Offices related to health education, physical education, recreation, and athletics, are comparable to those of other administrative units of the college or university. Thus, the same levels of quality are applicable.

SELECTED REFERENCES

Brewster, Sam F., *Programing, Planning and Construction of College and University Buildings*. Provo, Utah: Brigham Young University Press, 1963.

Caudill, William W., *Toward Better School Design*. New York: F. W. Dodge Corp., 1954.

Guide for Planning School Plants. East Lansing, Mich.: National Council on Schoolhouse Construction, c/o Floyd G. Parker, Secretary, Michigan State University, 1964.

MacConnell, James D., *Planning for School Buildings*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1957.

National Council on Schoolhouse Construction, *Time Saver Standards*. New York: McGraw-Hill Book Co., 1964.

Planning America's School Buildings. Washington, D.C.: American Association of School Administrators, 1960.

Ramsey, Charles G., and Sleeper, Harold R., *Architectural Graphic Standards*. New York: John Wiley & Sons, Inc., 1956.

Schools in the U.S.A., Building Bulletin No. 18. Washington, D.C.: U.S. Government Printing Office, 1961.

Chapter 13

RESEARCH AND TEACHING LABORATORIES

Research facilities are becoming increasingly important in colleges and universities. In the quest for new ideas and in the reexamination of old ones, research plays an important role. However, it must be remembered that the acquisition of research facilities and equipment does not guarantee that valuable research will be conducted. Facilities and equipment are only tools that must be used in an effective manner if meaningful results are to accrue. An inquiring, open-minded attitude must be maintained or the contributions from the use of research tools will be meager.

It is impossible to list the research tools that any one individual investigator will want to use in doing research. A laboratory, in a sense, takes on the personality of the one who is in charge of the research being conducted there. The mature investigator will very frequently develop his own research equipment or modify apparatus already in existence. Also, the equipment to be used determines to some extent the facilities in which it will be housed.

The very nature of investigation and investigators demands freedom to work in almost any direction. The listing of facilities and equipment tends to stifle this freedom—to stereotype the work being done. The investigator himself is the only person in a position to determine his own interests and the directions which will produce the most valuable results. Hence, only he can judge what kinds of facilities and equipment will be needed. The strength of research lies in diversity of approach.

Despite the wide diversity in research tools, there are some facilities and equipment which are commonly used in laboratories for research in health, physical education, and recreation. A list of manufacturers (including addresses) of research equipment appears in Appendix L.

Some aspects to be kept in mind in planning research facilities, and how these facilities can be utilized most efficiently will be suggested in the first section of this chapter. The second part contains typical types of laboratories associated with departments of health, physical education, and recreation, or those which might be expected to be developed in the future.

GENERAL CONSIDERATIONS

There are a number of general considerations which will have an important bearing in determining specific laboratory requirements.

AIMS OF THE INSTITUTION

The nature of the educational institution and its objectives and function will determine in large measure the type, number, size, and relative importance of research and teaching laboratories in the department of health, physical education, or recreation. In junior colleges, or in four-year institutions in which only service courses comprise the department offerings, elaborate, sophisticated research laboratories will seldom, if ever, be required. However, laboratory experience may be desirable as a part of a health education or other course. Likewise, some testing equipment may be required

for use in the gymnasium or on the playing field. Furthermore, there are liberal arts colleges and other research-oriented institutions whose undergraduate curriculums require that the student have research experience. In such institutions, it is not unreasonable to expect the department of health, physical education, or recreation to provide limited research facilities and supervision of selected research activities.

In colleges and universities offering professional preparation in health education, physical education, or recreation, there is, of course, a greater need for the development of research and teaching laboratories. This is particularly true where graduate curriculums exist in these areas. Such facilities are required not only to provide experience and training for students, but also to attract and retain capable research scholars. Therefore, it is not possible to decide on a "per student" basis what kinds of laboratories, or even, in many instances, how many square feet of laboratory space should be provided. The character of the institution and the interest and ability of its faculty must be taken into account before decisions are made on these matters.

TEACHING AND RESEARCH LABORATORIES

In the early stages of professional preparation of students in departments of health, physical education, and recreation, small research laboratories served as teaching laboratories in the conduct of various undergraduate and graduate courses. It is still necessary and desirable to use research laboratories for presenting occasional demonstration experiments in the teaching of classes. However, this cannot be a frequent practice in a productive research laboratory, especially when the classes contain more than just a few students.

Separate teaching laboratories should be provided to handle laboratory sections of various courses. There is no reason why the same teaching laboratory cannot be utilized for conducting some of the laboratory sessions in a variety of courses, including tests and measurements, physiology of exercise, and biomechanics. At least one such teaching laboratory should be available which is equipped with stationary lab tables containing gas, water, and electricity. Hoods for the Bunsen burner, cabinets for storing small pieces of equipment, and a connecting supply room are also essential. Closed-circuit television receivers are desirable. The laboratory can be designed to accommodate equipment used in conducting experiments with animals and human beings.

Frequently, the teaching laboratory can be equipped with durable, inexpensive, and easily-serviced apparatus where students can carry on experiments individually or in small groups. While such equipment may not provide the degree of precision expected of sophisticated research apparatus, it is generally accurate enough to present desirable principles. A space of approximately 1,000 square feet, with a 12-foot ceiling, is generally large enough to accommodate a class of 20 students.

A small gymnasium of approximately 2,000 square feet or more, with a ceiling height of 24 feet, may function as another teaching laboratory for conducting other kinds of experiments. This facility is useful for instructional purposes and for the student to gain experience in administering tests and taking measurements. Such a facility should be free of obstructions so that fitness or sports tests may be safely administered. Walls should be flat, without ornamentation or equipment, to permit wall-volley tests to be conducted. Such items as chinning bars, mats, and volleyball standards should be available for administering a wide variety of sports and other tests.

As the fields of health, physical education, and recreation advance in maturity as disciplines, it is probable that laboratory experience will replace some of the course lectures, particularly in courses at the graduate level. This will increase the need for teaching labs as well as research labs. Graduate students should have considerable laboratory experience before they embark on the collecting of data for the writing of a doctoral dissertation.

INDIVIDUAL LABORATORIES

Several forces are acting to accentuate the role of the research investigator in colleges and universities. The availability of funds, greater specialization, increased research encouragement from the administration, and competition for university faculty have all had a positive influence on the place of research. The recent interest within the fields of health, physical education, and recreation in developing a body of knowledge, and the development and expansion of graduate programs in these fields have also created a greater demand for research facilities and trained investigators.

A few years ago, there was rarely more than one faculty member in these fields engaged in research, even in large departments or schools. The picture is changing so rapidly that now a sizable proportion of some faculties are doing research—sometimes several faculty members sharing a common interest or specialty. This is similar to conditions which have existed for some time in many other disciplines. Provisions must be made for this development.

It should be recognized that often each investigator will require a laboratory or research facility for his own use, even though it may be modest in scope. Investigators who are likely to make the greatest contributions in research are, for the most part, independent thinkers, and must function on their own much of the time. This is not to imply that the investigators should not be expected to share major facilities, expensive apparatus, or supporting services. But each "cook" can be expected to desire at least a small "kitchen" of his own.

Joint appointments, in which a faculty member holds an appointment in more than one department, are increasing in number in departments of health, physical education, and recreation. Provisions should be made for some faculty members to do research in other departments, and, conversely, members of other departments may be expected to use some of the health, physical education, and recreation research facilities.

A related development is the organization in many large universities, of centers or institutes for research which cut across departmental lines. There are a number of advantages to such organizational setups, including the cross-fertilization of disciplines and the sharing of elaborate facilities and expensive apparatus. In the planning of research facilities for health, physical education, and recreation, the

existing as well as the proposed institutes on the campus should be investigated.

SERVICE FACILITIES TO BE SHARED

Although there is a need for individual research laboratories, some facilities lend themselves to shared use. A workshop supervised by a capable machinist or other skilled worker is an essential ancillary facility in institutions where considerable research is being conducted. If the research productivity of the health, physical education, and recreation unit is sufficiently great, there is justification for housing and supporting this type of ancillary facility in this unit. If, however, research and laboratory teaching is done on a smaller scale, the facility may be shared by other units in the college or university, or such services may be purchased as needed.

If a workshop is planned, 110v and 220v electric current with good ground connections should be made available. Oversize doors should be provided as well as a good ventilation system so that sawdust and other pollutants will not become a hazard or annoyance. Cupboards with locks should be in ample supply to store hand tools to prevent their being stolen or misplaced. Since considerable noise may be generated, the workshop should be isolated from other facilities where quiet work is being done. There should be a minimum of 80 footcandles of light on the task being performed. The room should be at least 500 to 600 square feet in size, with a ceiling height of 12 feet.

Another unit which lends itself to shared use is a data-processing center. This may be a small room housing a few desk calculators which are available for use by various faculty members, graduate or undergraduate students, and nonacademic personnel. On the other hand, the facility may be expanded to include card punching and sorting equipment, tabulators, collators, and magnetic or punch-tape equipment. There may also be computer consoles which connect by telephone or other lines to a large centralized computer on the campus, or even at other institutions. Computer consoles located in various buildings on the campus will be the most common way of providing computer services at large universities. Punch cards or tapes will not have to be transported across the campus with the use of this arrangement.

Regional electronic library services are being planned for various locations in the United States. Provisions should be made for making use of this service.

The installation of punch-card and computer equipment requires the installation of large electrical conduits, good ground connections, and oversize doors. A great deal of heat may be expected to be generated by the electronic equipment, so some means of dissipating this heat will be required. Space should be provided to permit direct access to each piece of equipment for servicing. Since considerable noise is developed when data-processing equipment is in operation, acoustical treatment of ceiling and walls is essential. The division of the area into smaller rooms with soundproof walls helps reduce the noise problem.

Other specific facilities may service a number of investigators. For example, the cost of such facilities as an environmentally-controlled treadmill room, or hot or cold room, or a barometric chamber is generally so high that only one such facility may be available in one institution, and thus must be shared. A photography dark room, which is an essential provision for a biomechanics laboratory, may also be needed by other scientists using a photographic recorder, or by someone teaching or doing research on posture.

The dark room, for obvious reasons, should not have an outside wall with a window. Therefore, good forced ventilation is essential. The room should be provided with running water, sinks, ample wall cupboards, and a generous supply of duplex electrical outlets (110v). The recommended room size is 225 square feet or more, with a 12-foot ceiling.

A number of researchers and teachers have need for graphic services for preparing materials for publication, for presentation at meetings, and for instruction. The types of cameras should be provided which can produce a 3-1/4" x 4" slide in a matter of a minute or two at little cost. Duplicating equipment may also be housed in this facility.

If the needs of the department are sufficiently large, a full-time or part-time person may be required to prepare graphic materials. A room used for this purpose should be well lighted—a minimum of 80 footcandles is recommended—and should have large wall cupboards for storing drafting and some camera equipment. A room with a minimum of 400 square feet and a 10-foot ceiling height will provide sufficient space for the usual requirements of this facility.

SUGGESTIONS FOR PURCHASING EQUIPMENT

The manufacturing of research equipment has become a very competitive business. As a result, there is frequently a variety of the same kind of equipment available. Before purchasing larger expensive units, it is worth the time and effort to investigate carefully the various makes. The annual meetings of professional societies generally include exhibits by manufacturers of research equipment appropriate to the particular area of investigation. For example, equipment and installations used for research in biological or health-oriented laboratories are exhibited at the annual meeting of the Federation of American Societies for Experimental Biology.

In considering particular pieces of equipment, one should consider: (1) whether students are to use the equipment; (2) what service the company is willing to provide and where the service centers are located; (3) whether the equipment is electronically compatible with other equipment now in use or contemplated (often it is more economical to purchase units that match others from the same company so that the responsibility for servicing them rests with one company); (4) what power supply is needed; (5) ease with which the instrument may be calibrated; (6) portability of the equipment; (7) initial and annual servicing cost; and (8) noise, vibration, and heat generated by the equipment. Unbiased answers to many of these questions can sometimes best be found by having discussions with other scientists who have used such installations.

OFFICE SPACE

Individual offices for the various faculty members and graduate students involved in research should be located convenient to the various laboratories. The installation of one or more rooms to be used for quiet work (e.g., calculating or reading) is helpful.

MOBILE LABORATORY

It is a basic axiom in research that data should be collected from a representative sample of the population to which the results are ultimately to be applied. For the sake of convenience of graduate students and professors, college freshmen have become the greatest tested population of the country. However, if educators are to learn about ten-year-olds, it is generally necessary to study and test ten-year-

olds. It is often more convenient to take research apparatus to the schools, camps, YMCAs, and other agencies than to bring the subjects to the laboratories. Hence, in planning research facilities, serious thought should be given to the development of a mobile laboratory. The trend to eliminate laboratory schools makes the consideration of a mobile laboratory more urgent.

Trailers, campers, trucks, and other vehicles—even railroad cars—have been converted into mobile laboratories. Often the use of a field generator is necessary to provide current for operating mobile-laboratory equipment. It is surprising how much equipment can be compactly installed in a mobile facility.

SPECIFIC LABORATORY FACILITIES

The information about laboratories listed in this section comprises only suggestions of how research facilities might be organized. Obviously, the character and organization of the institution itself will be an important factor in determining how facilities are to be organized and administered. In one institution, for example, health education may be the responsibility of a School of Health, Physical Education, and Recreation. In another, it may be the responsibility of the School of Public Health. In one university, exercise physiology is taught in the Department of Physical Education. In another, this responsibility rests with the Department of Physiology.

MEASUREMENT AND EVALUATION

Much of the so-called practical or applied research will be conducted in the gymnasium, swimming pool, and other indoor and outdoor activity areas. This means that in order to utilize measurement and evaluation equipment effectively, the regular activity areas must be planned and constructed in such a manner as to facilitate the conduct of research. For example, many skill tests are administered with the use of some type of wall volley as a part of a battery to measure skill in a certain activity. Therefore, it is important to construct the walls of a gymnasium so that present tests as well as those developed in the future may be utilized.

Consideration should be given to the attachment of special equipment to walls and ceilings, such as jump boards, ropes, and strength-measuring devices. Grids could be painted on the walls of the gymnasium as well as on the wall of a diving well in the swimming pool in order to measure distance and height when analyzing movement.

Much of the research equipment needs to be portable so that it can be moved to the action areas. This means that proper electrical outlets and suitable acoustical treatment of these areas must be planned for in advance.

These laboratories will contain the equipment that will be used at the elementary, junior, and senior high school levels. Physical education teachers at these levels should be encouraged to make use of some of this equipment on the job.

The following items of equipment are representative of the kind used in this type of laboratory:

- RGS equipment
- Sphygmomanometer
- Stethoscope
- Audio-electronome
- Visual-electronome
- Mechanical metronome
- Chest calipers (small)
- Purdue pegboard
- Sliding calipers
- Minnesota Block Test
- Tensiometer
- Back and leg dynamometer
- Electric chronometer
- A video-tape recorder with playback attachment
- Skinfold calipers

RESEARCH AND TEACHING LABORATORIES

- Lincoln Oseretsky test kit
- Slide rules
- Stadiometer
- Automatic performance analyzer
- Hand dynamometers
- Muscle tonometer
- Elgin exercise table
- Stop watches (100th of a second)
- Multiple angle testing unit
- Storage cabinets (adequate for equipment, metal, 18" x 36", with locks)

An instructional laboratory in the elementary school should contain facilities and equipment which could be used to provide opportunities for the development of the child's body from the waist up, and, at the same time, be used to measure his ability to lift his own weight, as is done in chinning or climbing. The following pieces of apparatus are suggested:

- 4 pairs of climbing ropes
- 4 pairs of climbing poles
- 4 pairs of swinging rings
- 1 wall adjustable horizontal ladder
- 1 set (3 sections) of stall bars

These pieces of apparatus will provide repeated opportunities for a class of 32 children to participate within a period of 25 to 35 minutes.

BIOMECHANICS (KINESIOLOGY)

There are many areas in the field of biomechanics in which research may be conducted. The type of research may range from cinematography to human engineering. If there is a physiology-of-exercise laboratory available, experimentation may take place in which the equipment from this laboratory is utilized jointly with the exercise physiologist, or used separately by the kinesiology researcher.

In cinematographic research (especially time lapse and high speed), a room 30' x 30', with a ceiling height of at least 24', is a necessity. Overhead, side, and beneath grid screens are needed. Special cameras whose speeds vary from 48 to several hundred feet per second are useful. Special film readers and projectors should be provided in order that accurate measurements may be made. The use of special mirrors to reflect images is also recommended.

Equipment representative of the type used in this kind of laboratory is as follows:

- Polaroid land camera (motor-driven)
- Bolex and Kodak reflex camera (motor-driven)
- High-speed camera (motor-driven)
- Stroboscopic equipment (including single and multi-flash units with strobolume and strobotac parts)
- Graphic view camera for use with stroboscopic equipment
- Force plates
- Multichannel recorder with high frequency response
- 35 mm reflex camera
- Video-tape recorder with two channels and with playback capacity
- Strain gauges and associated equipment
- Oscilloscope
- Electronic counters
- Amplifiers
- Two metal storage cabinets (approximately 18" deep by 36" wide) with locks
- Turntables
- Balometers

- Reaction measuring devices
- Taximeters
- Sargent jump and reach boards
- Anthropometric devices
- Electromyograph facility (In addition to electrodes and a multichannel recorder with appropriate amplifiers, the room will normally have to be enclosed with copper screening or other material to eliminate electrical interference.)

Special simulated game areas may be constructed so that a true picture of a performer in action may be studied. This may mean that a miniature running track is developed, as well as other similar replicas of playing areas. Nets and other devices may need to be used to catch objects or to prevent them from traversing the customary distance.

PHYSIOLOGY OF EXERCISE

In planning facilities for research in the area of physiology of exercise, it is well to anticipate that research with animals as well as with human beings may be conducted. Although most of the interest of physical educators is in applied research in which human subjects can be used, nevertheless, much valuable work can be done inexpensively with dogs and smaller animals. Equipment is available for exercising many kinds of animals. The effects of either forced or spontaneous exercise may be studied. Some suggestions for facilities in this area are given below.

EXERCISE ROOM (HUMAN BEINGS)

An area of at least 40' x 40', providing a minimum of 1,600 square feet of space, should be provided for the exercise room for human beings.

The most popular methods of standardizing exercise in human beings are as follows: (1) by means of a motor-driven treadmill, bicycle, or other ergometer; and (2) step tests of various kinds. The exercise room should be large enough to accommodate all of the needed equipment. There should be space for five technicians as well as for scientific instruments (e.g., a Tissot tank).

Since some noise and vibration result when the treadmill is operating—and some treadmills are quite heavy—it is well to locate this room on the ground floor, with provisions for reducing noise. The treadmill should be installed in a pit (and even on a pad to help further reduce noise), if possible, with space in the pit for servicing.

The room should be air-conditioned, with control over temperature within a $\pm 1\frac{1}{2}$ degrees Fahrenheit, and control over humidity of ± 5 percent. Electric current (110v and 220v) should be supplied through numerous outlets. A large thermopane observation window should also be installed.

A room 20' x 25', with a ceiling height of 12 feet—to allow for walking, running, or riding a bicycle up a grade on the treadmill—is generally sufficient. If the treadmill is not installed in a pit, the ceiling may have to be higher. It is usually desirable to have connecting cables, including voice communication, to space adjoining the exercise room so that desirable data can be recorded outside the room. The kinds of equipment found in the exercise room, in addition to exercising apparatus, might include:

- Multichannel paper recorder
- Tape recorder (multichannel)
- Gas meters
- Cot
- Telemetering apparatus
- Electronic gas analyzers
- Douglas or metecrological bags
- Barometer

ANALYTICAL ROOMS

The number of analytical rooms will depend upon the extent of the research being conducted and the number of investigators involved. These rooms should be a minimum of 20' x 20' each, with a ceiling height of 10 feet. They should be air-conditioned and should contain the benches, cabinets, sinks, fume hoods, and air, gas, and electrical-current supplies usually found in laboratories of this type. The typical kinds of equipment used in these rooms include:

- Chemical gas analyzer
- pH meter
- Analytical balance
- Still
- Spectrophotometer
- Refrigerator or freezer
- Centrifuge
- Microscope
- Autoclave
- Glassware
- Bunsen burner
- Desk calculator

ANIMAL EXERCISE ROOM

This room should be similar to the exercise room for human beings except that it may be smaller—300 to 350 square feet, with a 10-foot ceiling. Treadmills for exercising dogs or smaller animals are no larger than half the size of human treadmills. Ventilation should be adequate to minimize odors and to discharge air. This air should not be permitted to circulate to other rooms. Terrazzo or other suitable floor surface, with ample drains to facilitate cleaning, should be provided. The equipment to be used should be similar to that found in the exercise room for human subjects.

ANIMAL HOUSING ROOMS

Cages for small animals should be in racks on casters to facilitate their transfer to a steam room. The steam room for cleaning cages should be on the same level and as close as possible to the housing room. The animal rooms should all have adequate ventilation to minimize odors, and the air should not be recirculated to other areas. The rooms should be air-conditioned and without natural light. Lights should be vaporproof, and automatic light control should be available. The electric current supply to this room, as well as to refrigerators and freezers, should be connected to an alarm at the plant department so that if a power failure occurs, this will be known immediately. An automatic recorder for continuous recording of temperature and humidity should be installed. Terrazzo or other suitable floor surface with adequate mudcrack drains should be provided. All surfaces should be glazed, and there should be a sill cock for hosing down the room. Only food, water, cleaning supplies, a scale, and a few other pieces of equipment are normally kept in the animal housing room.

ADDITIONAL FACILITIES

In many departments, additional major facilities may be required. Because research in exercise physiology is closely related to research in environmental physiology and nutrition, the following facilities may be needed:

- Barometric chamber (with space for controlled exercise)
- Hot room (with space for controlled exercise)
- Cold room (with space for controlled exercise)
- Diet kitchen
- Flow through water tank for studying energy metabolism during swimming and rowing
- Isotope storage, handling, and counting equipment

MOTOR LEARNING AND PSYCHOLOGY OF SPORTS

Much of the research equipment found in psychology, physiology of exercise, and kinesiology (biomechanics) laboratories can be utilized in conducting research in motor learning and psychology of sports. However, it is necessary to have a separate room or facility, at least 30' x 30', with a 12-foot ceiling.

The arrangement of the equipment in the room will depend on the research underway at the moment. In any event, the electrical devices that are used should not be constantly moved or they will become unusable.

Some of the equipment which might be included in a laboratory for research in motor learning and psychology of sports is as follows:

- Multichannel recorders
- Standard electric clocks
- Interval timer
- Steadiness units
- Muscle stimulator
- Electronic counters
- Variable power supply
- Voltage stabilizer
- Battery charger
- Seashore test
- Electronic kits
- Audio amplifiers
- Microphone
- Audio oscillator
- Oscilloscope
- Telemetry transmitter
- Telemetry receiver
- Magnetic tape recorder
- Storage cabinets (metal, with locks)

HEALTH EDUCATION

Some specific research facilities should be provided for research in health education. The following are recommended:

- A room for plant and animal feeding experiments (500 square feet):
 - Some natural sunlight (not for animals)
 - Special humidity and temperature control, and exhaust ventilation (elimination of animal odors)
 - Cages (for small animals and/or birds)
 - Sink with hot and cold water
 - Refrigerator (for storing isotopes and biologicals)
 - Steam room for cleaning cages
- A laboratory room and workroom (with sink, running water, gas, and electrical supplies; air-conditioning with humidity control):
 - Storage cabinets (two or more, metal, with locks)
 - Refrigerator with freezer to 0°F.
 - Incubators (bacterial style, egg)
 - Food scales (grams) and animal scales up to 10,000 grams
 - Glassware (beakers, flasks, test tubes, racks, etc.)
 - Binoculars
 - Balance (analytical) scales (automatic type)
 - Gas burners (Bunsen)
 - Digestion flasks, etc.
 - Autoclave (sterilizer)
- Storage room (300 square feet) should house:
 - Specimen cabinets
 - Teaching aids
 - Large (flat) map cabinets
 - Bookshelf-type cabinets
 - Cabinets (with glass doors and locks)
 - Closet space (for skeleton, etc.)
 - Old equipment which may be modified for new experiments
 - Experimental teaching aids (mannequins, skeleton, models, charts, motion-picture projector, overhead projector, and opaque projector)
 - Film strip and slide projector
 - Microscope (with turntable and amplifier)
 - Micro-projector

RESEARCH AND TEACHING LABORATORIES

Vision and hearing test equipment
X-ray film viewer

- Small classroom to seat 24 (with observation deck providing one-way vision)

SAFETY EDUCATION

Many institutions have special facilities for research in safety education. Some recommended facilities and equipment items are as follows:

- Simulator laboratory (600 square feet):
 - Aetna Drivotrainer
 - AAA auto trainer
 - Driver trainer
- Psychophysical testing laboratory (720 square feet) for testing:
 - Visual acuity
 - Distance judgment
 - Field of vision
 - Color vision
 - Night vision
 - Glare vision
 - Glare recovery
 - Reaction time
 - Steadiness test
- Safety Education Laboratory (500 square feet):
 - Equipment for testing:
 - Protective devices for industrial accident prevention
 - Protective devices for use in physical education, athletics, and recreation

Multiple-car off-street driving range (at least 350' x 450'; see Figure 40)

RECREATION

The research facilities of other disciplines, such as those of psychology and sociology, should be made available for use by the recreation-department personnel. However, it is recommended that a special camp site, where experimentation with human subjects may be conducted, be developed by the college or university. Studies of plant life and soil conditions may also be made at such camp facilities.

Computer facilities should be utilized by the graduate students and faculty of the recreation department. Therapeutic recreation researchers should utilize the research facilities of medical schools, as well as those of state and local hospitals. The establishment of model community centers and playgrounds on the campus could provide ideal settings for research being conducted on leadership and program problems.

HISTORY AND SOCIOLOGY OF SPORTS

Little in the way of special facilities is recommended for research in the history and sociology of sports. In addition to office space, research workers in this area might require rooms for the storage and use of manuscripts, rare books, tapes, and video-tape collections. Reproducing equipment and microcard or microfilm readers might also be needed.

SELECTED REFERENCES

Barrow, Harold M., and McGee, Rosemary, *A Practical Approach to Measurement in Physical Education*. Philadelphia: Lea & Febiger, 1964.

Clarke, H. Harrison, *Application of Measurement to Health and Physical Education*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1967.

Larson, Leonard A., and Yocom, Rachael D., *Measurement and Evaluation in Physical, Health and Recreation Education*. St. Louis: C. V. Mosby Co., 1951.

Mathews, Donald K., *Measurement in Physical Education*. Philadelphia: W. B. Saunders Co., 1963.

Meyers, C. R., and Blesh, T. E., *Measurement in Physical Education*. New York: Ronald Press Co., 1962.

Research Methods Applied to Health, Physical Education, and Recreation. 2nd ed. Washington, D.C.: American Association for Health, Physical Education, and Recreation, 1959.

Scott, M. Gladys, and French, Esther, *Measurement and Evaluation in Physical Education*. Dubuque, Iowa: Wm. C. Brown Co., 1959.

ON-CAMPUS AUXILIARY AND DECENTRALIZED FACILITIES

One of the problems generated by increasing enrollments in colleges and universities is the shortage of physical education and recreation facilities for use by the large number of students living on the campus. Experience has shown that it is most difficult, if not impossible, to include enough space in the regular physical education and recreation facilities to accommodate all students who want to use these facilities. Various methods of solving this dilemma have been attempted by different institutions, and there has been some success in alleviating the problem.

As student populations increase, a degree of decentralization and utilization of auxiliary resources becomes necessary in many aspects of campus life. This is particularly applicable to student housing, food service, classroom space, and recreation facilities.

When planning for the health, physical education, and recreation needs of college students through auxiliary and decentralized facilities, it is recommended that planning committees or coordinators:

- Consult with members of the health, physical education, and recreation departments in the early planning stages
- Emphasize the need for instructional and recreational facilities for college students
- Establish justification for the decentralization of facilities
- Develop specifications for the design, layout, and location of facilities
- Plan appropriate provisions for the use and accessibility of facilities for both men and women in coeducational housing units
- Identify those areas specifically designed for the exclusive use of men or women (e.g., weight-lifting rooms for men)
- Establish procedural policies which will provide optimum opportunities for the growth, development, and happiness of students

STUDENT-UNION BUILDINGS

One of the first concepts to illustrate the utilization of auxiliary facilities for recreation and other student services was the student-union-building concept. Most institutions of higher learning now consider a student-union building an essential aspect of the campus building complex. Facilities in these buildings provide an avenue for student participation in a wide range of recreational activities, and serve as a supplement to similar facilities ordinarily included in centralized gymnasiums, field houses, and similar areas. Since administrators of union buildings are convinced of the importance of providing a variety of recreational facilities for college students, this aspect of the union program will likely be expanded rather than curtailed in future planning.

RECREATION BUILDINGS

Another concept involving the utilization of auxiliary facilities, which has been implemented on some campuses, is the construction of a building primarily intended for the development of recreational and intramural activities for both men and women. Most institutions providing instructional programs in health education, physical education, and recreation, in addition to recreational and intramural activities, will find such a building an important adjunct facility.

Where adequate instructional facilities are available elsewhere on the campus, the use of the recreation building for instructional purposes may be very limited. If such a building is used primarily for instructional purposes, there should be some unassigned space available for recreational use by students during all periods of the school day.

Figure 41 shows the floor plans of a recreation building.

LIVING-LEARNING CENTERS

A recent trend in educational practice is to create separate college or university units where sections of a larger student body are grouped together according to classes, study concentration, intellectual interests, or other means. Students in these smaller units are usually housed together, separate from other students on the campus. Provisions for classrooms, laboratories, and other facilities necessary for implementation of the teaching-learning process are included in this homogeneous complex, which may be described as a college within a college.

When such complexes are planned, it is essential that attention be given to student needs for instruction in physical education activities and for opportunities to pursue recreational interests. The administrative policies for the operation of these units usually imply complete self-containment, so it is important that physical education and recreation facilities be included as an integral part of the complex. Since use of these facilities will be limited to instruction and recreation, with no requirement for spectator space, certain economies can be effected in building costs.

Facilities in these centers should include those listed below for dormitory complexes, plus those necessary for the implementation of a complete program of health, physical education, and recreation for all students residing in the center. Standards governing the construction, size, and number of these facilities are included elsewhere in this **Guide**.

DORMITORY COMPLEXES

Another situation which creates problems is the increasing tendency to develop housing units, or complexes, at the edge of the campus, far removed from existing physical education and recreation facilities. These residence units,

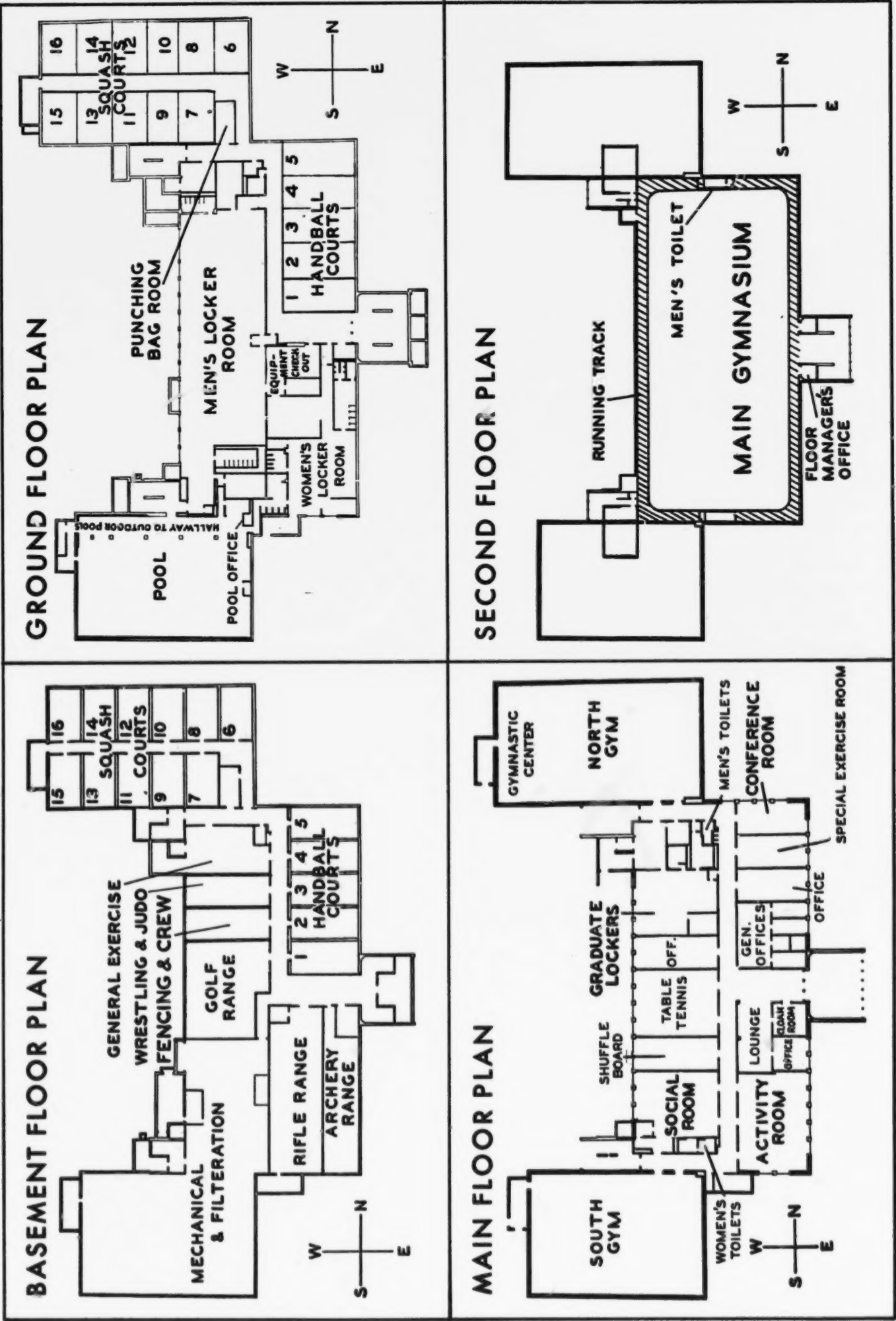


Figure 41
Recreational Gymnasium, Purdue University

sometimes housing several thousand students, illustrate clearly the need to provide a variety of recreational-activity areas which are easily accessible to the resident student.

When planning dormitory complexes, careful attention should be given to the provision of adequate recreational facilities, both indoor and outdoor. The planning should include the designation of space to be reserved and developed in order to meet adequately the present and future needs of students living in the residence units. When existing housing units have inadequate provisions for recreational facilities, it may not be possible to provide additional indoor facilities. In such instances, consideration should be given to the development of outdoor facilities on nearby outdoor space that may be available. Listed below are suggestions for facilities, both indoor and outdoor, which should be included in connection with housing complexes.

OUTDOOR FACILITIES

The following outdoor facilities should be provided for dormitory complexes.

- Paved multipurpose area, 60' x 120', for each dormitory and equipped as follows:
 - Painted lines for basketball, volleyball and other court games
 - Basketball goals and backboards
 - Sleeve inserts for poles to support nets
 - Rebound backboards or rebound nets
- Turf playing field, 260' x 360', for soccer, touch and flag football, and softball
- Battery of four to six tennis courts located within easy access of housing units
- Outdoor picnic, relaxation, and sunning areas which provide:
 - Paved area for shuffleboard; turf for such activities as croquet and lawn bowling
 - Picnic tables, and fireplace equipped with cooking facilities
 - Area for sunbathing and relaxation
 - Sheltered area for patio and benches

INDOOR FACILITIES

The following indoor facilities should be included in each dormitory:

- Game rooms for billiards, table tennis, shuffleboard, and table games
- Large unobstructed area suitable for such activities as dancing, mixers, and the showing of movies
- Lounge and reading rooms
- Weight-lifting and exercise rooms
- Storage room for equipment for games and sports

GUIDE LINES FOR PLANNING RECREATIONAL FACILITIES IN DORMITORY COMPLEXES

- Standards governing construction of these facilities should conform to those included elsewhere in this **Guide**.
- Facilities should be located near housing units, within easy reach of the students.
- Facilities should require a minimum of maintenance (e.g., use of paved materials and artificial turf where feasible).
- Facilities should be available for student use during evening as well as daylight hours. This suggests adequate lighting equipment supplied with automatic timing devices which are also subject to manual control.
- Equipment for use at these facilities should be housed nearby and be readily accessible to students at all times.
- If reservations for use of facilities are necessary, they should be easily arranged for by the student at the housing center where facilities are located.
- Use of the facilities should be limited to the college or university student and not be open to the general public, except during vacation or other periods when the students are not in residence.
- In general, these facilities should not be used in organized or instructional programs unless such programs can be arranged so as not to interfere with student use of the facilities during leisure hours.
- These facilities should be so arranged that supervision can be kept to a minimum.
- Dormitories housing married couples should have playground space equipped with play equipment appropriate for use by children of all ages.

SELECTED REFERENCES

Berry, Chester A., *Planning a College Union Building*. New York: Bureau of Publications, Teachers College, Columbia University, 1960.

Crane, W. J., "Practices and Problems in Residence Hall Planning," *Personnel and Guidance Journal*, January, 1962, pp. 448-452.

Dober, R. P., *Campus Planning*. New York: Reinhold Publishing Corp., 1963.

Higgins, E. E., et al. *Residence Hall Planning Aids*. Washington, D.C.: College and University Physical Facilities Series, U.S. Office of Education, 1965.

Stevens, George F., *The Union Recreation Area*. Ithaca, N.Y.: The Association of College Unions, 1965.

Chapter 15

OUTDOOR EDUCATION AREAS AND FACILITIES

The increasing interest in outdoor education has significant implications for college and university curriculums. This interest has resulted in an unprecedented need for more adequate land areas and facilities to supplement the existing physical resources of a campus complex.

Outdoor education, as currently conceived, is a means of curriculum enrichment and program improvement through the use of the outdoors and natural resources. It is multidisciplinary in character, cutting across many subject-matter areas and activities. In its broadest sense, outdoor education encompasses the use of the outdoors as a laboratory for learning and for acquiring the knowledge, skills, and appreciations necessary for the enjoyment of the outdoors in the constructive use of leisure time. The outcomes represent many of the objectives of education through a deepening of perception relating to human and natural resources.

In planning areas and facilities for outdoor education in colleges and universities, consideration should be given to the wide variety of functions of institutions of higher education to which outdoor education can contribute. These include the curricular offerings in many disciplines and activities, teacher and leadership preparation, campus recreation and continuing education, and educational and recreational services to the college or university community.

The outdoor education areas and facilities described herein are integral parts of the large college or university campus and constitute a complex which will serve the educational programs of the individual schools and departments therein. The responsibility for the planning and administration of an outdoor education complex may be under the jurisdiction of one school or department, or may become the responsibility of several schools or departments.

In addition to areas and facilities owned by the college or university, there are many lands and structures, public and private, which can and should be used to supplement the teaching resources of the institution. Plans for development should consider future growth in outdoor education.

RESIDENT CENTERS FOR OUTDOOR EDUCATION AND CAMPING

The resident outdoor education center operated by a college or university serves many areas of the total curriculum. Such a center can provide the facilities for meaningful experiences in the techniques of teaching in outdoor settings. Students preparing to teach can be provided with opportunities for broadening their understanding of conservation and utilization of natural and human resources.

The resident center should be used to prepare future camp leaders and outdoor recreation specialists. It should also be utilized to enrich the curriculum in the areas of the natural resources, social sciences, and special education. In order to make the program fully practical and meaningful, children from the campus laboratory school, or public schools within reasonable distance from the campus, should be in attendance with the college or university students.

Otherwise, the advantages of such unique laboratory experiences are not fully realized.

SITE CHARACTERISTICS

When a site for an outdoor education center is considered, the program and ultimate utilization of the area should be factors of prime importance. Because of the diversification of outdoor education programs, the multiple-use aspect should receive serious consideration. It is quite possible that an outdoor education center may serve for public school outdoor education, college outdoor education classes, children's summer camping, family camping, therapeutic camping, and camping for older adults. The site should have potentialities for the establishment of a physical plant that might meet all of these purposes and interests.

Another consideration must be the maximum number to be served at any one time. Most centers are designed to serve 150 or more participants. The site, accordingly, should contain at least 150 acres, since "an acre per participant" is a sound guide in the selection of an outdoor education center. This guide might be waived if the land under consideration is immediately adjacent to a large tract of public land which would be utilized for program purposes.

Any site which is ultimately selected for the establishment of a resident outdoor center should possess special features. If any of them is lacking, the achievement of a complete program might be seriously hampered, or the health, welfare, and safety of the participants might be compromised. It is, therefore, imperative that any site under consideration possess the following characteristics:

- Sufficient isolation to provide a degree of privacy and serenity
- Reasonable accessibility to established roads, enabling year-round use
- A minimum of natural and man-made hazards
- A variety of native vegetation, including woodlands
- Rolling terrain with some open fields
- Wildlife habitat that can be maintained with good management
- Accessibility to a pond, lake, stream, or seashore
- Natural areas that may be developed for scientific study and exploration
- Soil conditions that will permit adequate drainage and adequate sewage disposal
- Accessibility to a sufficient and safe water supply
- Proximity to adequate hospital services

SELECTING THE SITE

Selecting a site for the establishment of an outdoor center is a difficult task. Prior to the ultimate decision, competent camp planners, architects, engineers, and program specialists should be consulted. Maps and aerial surveys should be used, and a ten-year weather map should be reviewed

in order to determine the climatic conditions that can be expected. The possibility of encroachment from future development of surrounding areas should also be considered, and a buffer zone should be included in the final purchase. The buffer zone should comprise a strip approximately 500 feet wide, running around the entire perimeter of the property. This strip would never be developed to any degree and would serve as a natural barrier to the encroachment of unsuitable developments.

Whenever possible, existing public lands should be used for the development of an outdoor education center. Many states permit colleges, school districts, and other governmental agencies to use state-owned lands for educational purposes. If such land is not available, then the possibility of purchasing land immediately adjacent to public land should be explored, since the educational potential would be enhanced through utilization of this public land in the program of the outdoor education center.

Prior to the final selection of a site, all potential users of the site, including school officials, youth-agency officials, and community recreation officials, should be consulted. It is well to be liberal in the determination of acreage to purchase, to allow for program expansions which may not be included in the first plan but should be anticipated in a master or long-term plan.

PLANNING THE LAYOUT OF THE CENTER

There is need for intensive study in the planning phase of any outdoor center. Good planning in the initial phase will ultimately mean better facilities, a considerable saving in both effort and cost, and better use for the center. The paramount considerations in planning should be: (1) the programs to be conducted; (2) the age and sex of participants in the various programs; and (3) the educational and recreational potential which the site offers. Consideration should also be given to the following: (1) roads and trails; (2) the location of major buildings, especially those requiring a water supply and sewage disposal; and (3) accessibility to water for educational and recreational purposes.

CONSTRUCTION OF FACILITIES

After the architect has been decided upon, considerable time should be spent in deciding on the type of facilities that will ultimately be constructed. Wherever possible, natural materials should be used, and the buildings should be designed and constructed so as to blend harmoniously with the natural setting. Nearly all of the standard building materials can be used to produce an attractive building which will blend in with the natural area. In selecting the materials for construction, those requiring the least amount of year-round maintenance should be carefully considered.

Prior to actual construction, a master plan of the total area should be formulated. Even if insufficient funds prevent the construction of all desired facilities during the first building phase, all potential buildings should be located on the master plan, and, wherever possible, a scale model of the total outdoor education center should be developed. Although this planning is sometimes time-consuming, it will contribute significantly to the ultimate utilization of the facility.

All buildings considered for the housing of participants and for program purposes should be winterized, and, wherever possible, the principle of multiple-use should be followed.

ROADS AND PARKING AREAS

After the tentative locations of the main buildings and living areas have been determined, the road-and-trail system should be studied. Every outdoor center should have two access roads. Although only one may be used, the second is important in the event of an emergency, such as a forest fire, flood, or snowslide, which may make the main access road inaccessible.

A minimum of vehicular traffic should be permitted in the living areas. Such roads should be considered service roads only and should not be open to the general public.

Parking facilities should be developed adjacent to the main administration building, with some provision for overflow parking to accommodate large groups for special occasions.

CARETAKER'S RESIDENCE

The caretaker's residence should be located on the main access road into the outdoor center. This placement assures a certain degree of security when the center is not in use. Since anyone entering the site must pass the caretaker's residence, this arrangement will tend to minimize vandalism and safeguard against the theft and destruction of valuable equipment.

ADMINISTRATION BUILDING

Without question, an administration building is ultimately necessary for the smooth administration of any outdoor center. However, it is not necessary to have this building constructed in the first phase of the building program.

When the administration building is constructed, it should include office space for the director of the center and adequate office space for other faculty members and key staff. A conference room and a room for clerical staff are also necessary. A workroom with space for storage, duplicating equipment, and the processing of mail should be included. There should be toilets for both men and women, and space should be provided for the processing of participants at the time of enrollment and departure.

DINING HALL AND KITCHEN

Housing for the dining hall and kitchen is a priority and should be constructed in the first phase of the building program. The dining area should be spacious enough to accommodate all participants, staff, and occasional guests. The food-dispensing area should be so designed that either cafeteria-style or family-style meals may be possible. Most programs will utilize family-style meals. On occasion it may be advantageous to use a cafeteria line, and the facility should be adequate for this type of service.

Since the outdoor center may, on occasion, serve two or more groups with different programs at the same time, it is sometimes desirable to have sliding panels that can divide the dining area into two separate units. Such an arrangement offers flexibility and is certainly desirable if more than one group is to be served at one time.

The kitchen area should include a food-preparation area, a cooking area, and a separate room for dishwashing and the return of dishes after use. A walk-in freezer and a walk-in refrigerator are also assets. A food-storage room with enclosed shelving is a necessity. All food-storage areas should be adequately rodent-proofed. A stove-exhaust system and food-preparations-center ventilating system are necessary.

OUTDOOR EDUCATION AREAS AND FACILITIES

LEGEND

- | | |
|-----------------------------|-------------------------------|
| 1. Living units | 12. Swimming area |
| 2. Office | 13. Council Ring |
| 3. Infirmary | 14. Staff Residence |
| 4. Trading Post | 15. Archery Range |
| 5. Director's Lodge | 16. Rifle Range |
| 6. Dining Hall | 17. Field Archery Range |
| 7. Staff Offices & Library | 18. Maintenance Storage areas |
| 8. Boat Dock | 19. Nature Center |
| 9. Sanitary units | 20. Trailer Sites |
| 10. Outpost units | 21. Campcraft Area |
| 11. Overnight camping sites | |

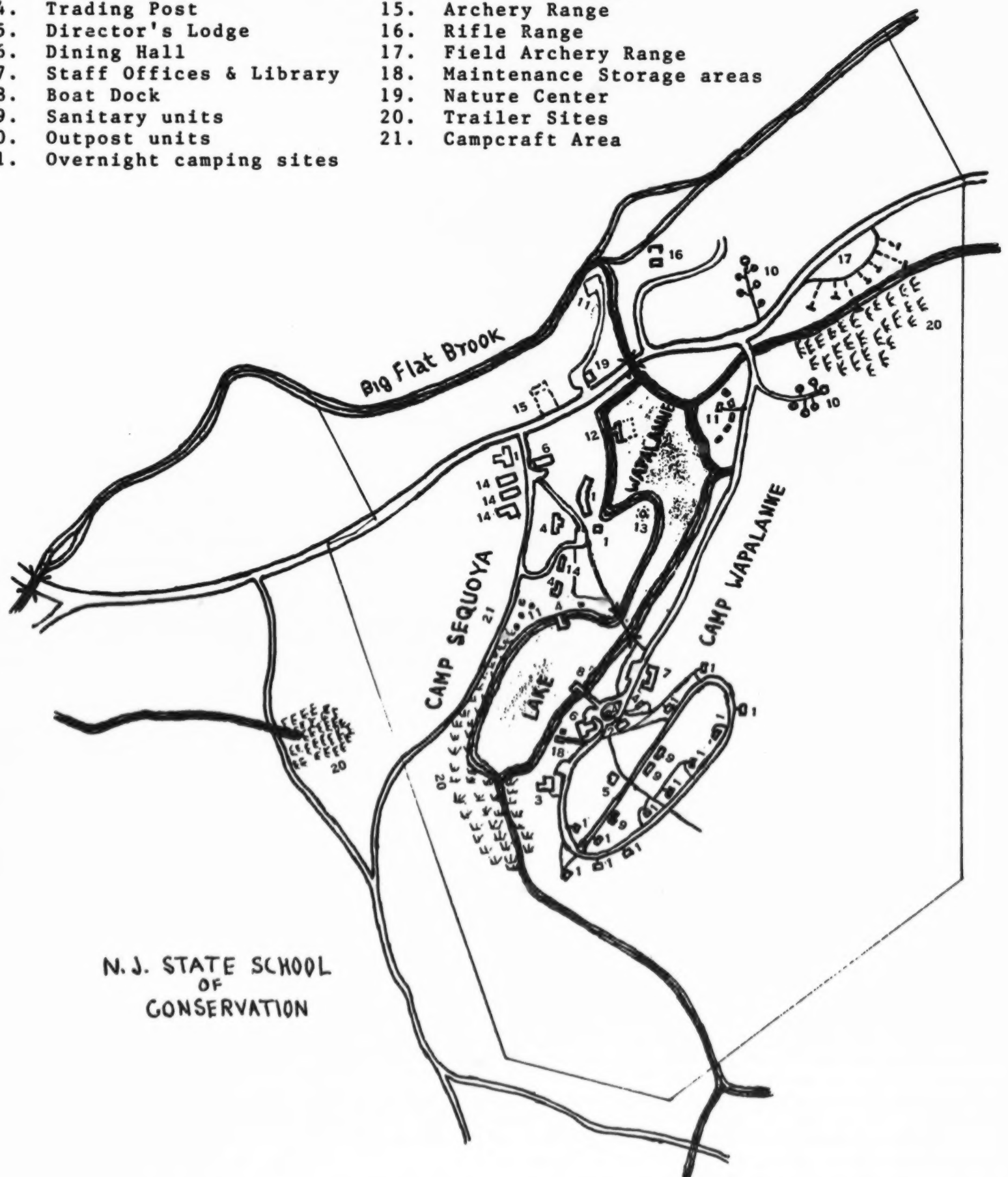


Figure 42
Resident Center for Outdoor Education and Camping

The actual location of sinks and stoves and other work areas depends on the overall design of the facility. Many different kitchen layouts can be used. Before the final decision is made, the architect and food-service specialists should be consulted.

Facilities in the kitchen area should include office space for the head cook or dietitian, and a service room for the dispensing of food and the storing of utensils for the kitchen.

A completely-enclosed garbage crib should be built outside the kitchen area. Garbage and refuse should be disposed of in a manner which meets the state health code. The kitchen staff should have toilet and hand-washing facilities available for their use. The fuel used for cooking should be either electricity or gas, and the trend seems to be toward electricity. The building should be well insulated and an adequate heating system should be installed.

In the dining area, there should be space to hang coats, hats, and foul-weather gear. The general atmosphere of the dining hall should be warm and relaxing. The lighting system should be ample and free of glare, and the lighting fixtures should be in keeping with the motif of the overall design of the center. Walls and ceilings should be smooth in order to facilitate cleaning. The surface of the floor should be of a material that is easy to maintain, with sufficient friction to mitigate falls. In the dining area, terrazzo makes a very good floor covering, although asphalt and vinyl-asbestos tile may be used. In the kitchen area, a grease-proof asphalt tile or nonskid quarry tile makes a practical floor covering.

HOUSING UNITS

The type of housing unit depends considerably on the program philosophy that is to be pursued. Some public-school outdoor educators have a preference for a large housing unit that will accommodate a teacher and the total class, while others prefer smaller cabins that will house individual program groups of eight to ten children with a group leader. The larger housing units will accommodate thirty to forty children and four to six staff members.

SMALL HOUSING UNITS

One of the advantages of small housing units is that they may be widely dispersed through the total camp area. Many times each cabin will house one program group with an adult leader (see Figure 43). Such a plan contributes significantly to an enriching of the social concepts of group living and also makes it possible for each small program group to develop its own identity. There seems to be little question but that smaller housing units add considerably to program development and also lend a degree of flexibility that is difficult to duplicate in the larger living unit. However, for year-round operation, small units are sometimes impractical because of the cost of a heating unit in each cabin. If oil or gas is to be used for fuel, large units are considerably less expensive to operate during the winter months.

In warm climates, small cabins should be given prime consideration. Each cabin should be constructed to accommodate eight to ten campers and one or two staff members. All cabins should be serviced with electricity, with at least one electrical outlet in the counselor's living area. If the cabins are to be winterized and have separate furnace units, each cabin should be so designed that the maintenance personnel can enter the heating room without actually entering

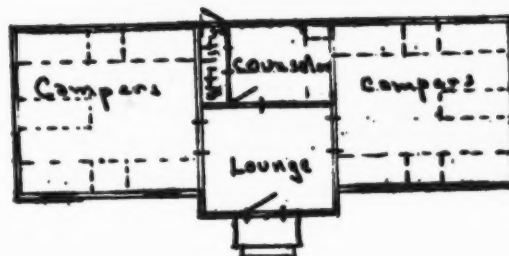
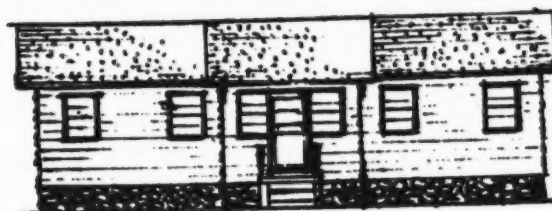


Figure 43
Small Housing Unit

the cabin. The need for a separate entrance to the heating room is self-evident in a coeducational center.

Since cabins are frequently dispersed throughout the living area, it is more economical to have toilet and shower facilities located in one central building rather than in the cabins. The slight inconvenience this arrangement may create represents a considerable saving in cost.

For spring, fall, and summer programs, temporary shelters, such as teepees, covered wagons, various types of tents and tarps, and Adirondack-type shelters are recommended (see Figure 44). In these temporary units, pit latrines may be used. However, they should be constructed to meet all existing health codes.

LARGE HOUSING UNITS

A large living unit, intended to accommodate 40 children and four to six staff members, should be so designed as to provide living accommodations for both sexes (see Figure 45). This can usually be accomplished by having the sleeping areas separated by a conference room or lounge area. It is suggested that the staff rooms be located immediately adjacent to the children's sleeping area, for better supervision and to provide an atmosphere of security for the children.

A workable arrangement is to have, in each wing, a sleeping area for 20 campers and a counselors' room or staff room with two or three beds. The ratio of staff to campers should be at least one to ten in such a facility.

In a large living unit, separate toilets should be provided for both sexes, and, when possible, shower facilities should be included in the building. Some outdoor centers contain what is referred to as a self-contained unit that, in addition to the sleeping and living quarters and toilet facilities, includes a small kitchen area. The inclusion of a kitchen makes possible a great degree of flexibility, since small groups may cook their own meals. However, this is not the most widely-used plan in the design of living units.



Lake Wapalanne
OUTPOST CAMPS
Covered Wagons and Domes

Figure 44
Temporary Shelters

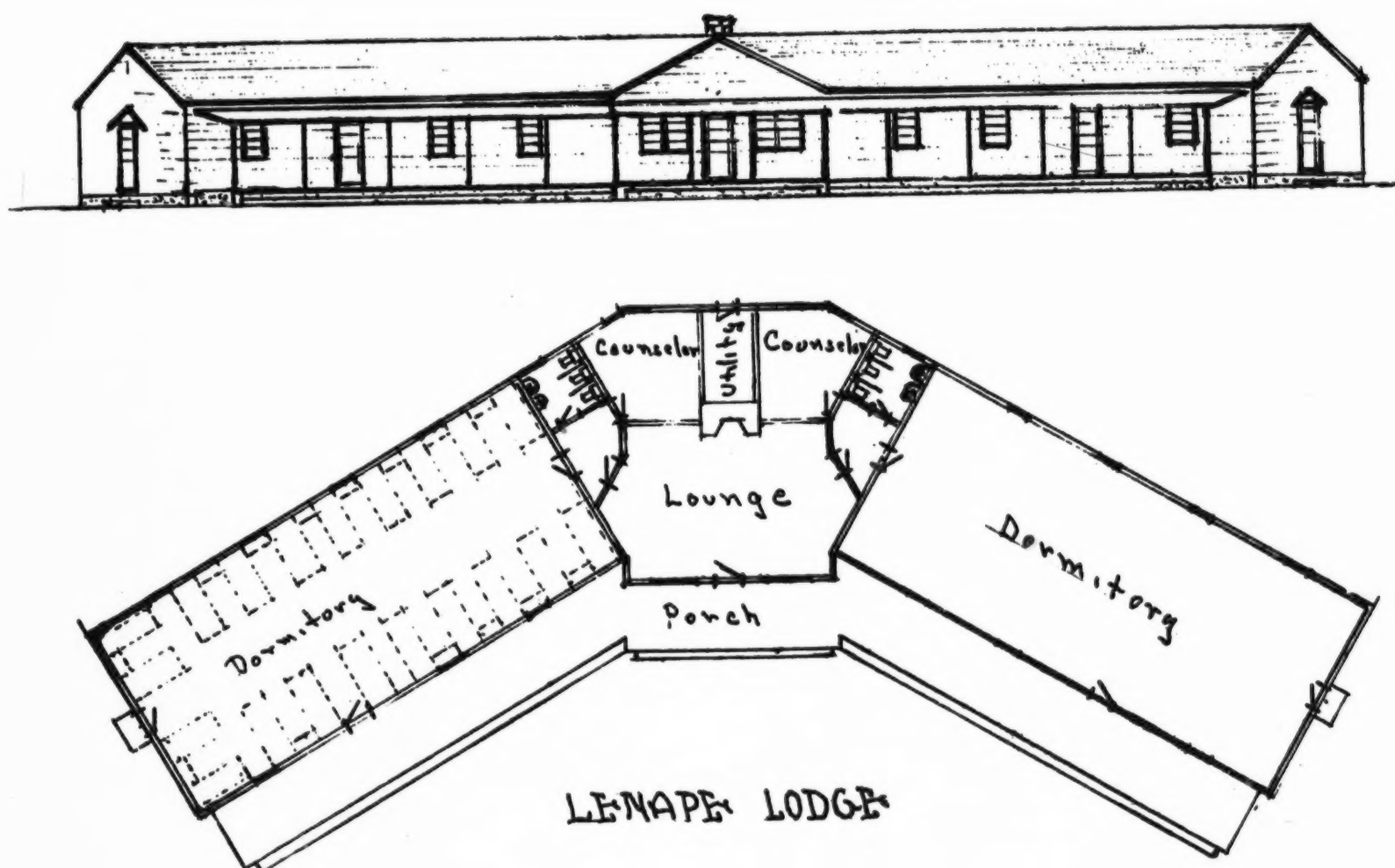


Figure 45
Large Housing Unit

When a large living unit is constructed, much consideration should be given to the architectural features. Careful planning is needed in order to fit a large building into a camp setting without destroying any of the natural beauty of the area. The heating plant and the type of insulation will depend upon the general location of the site.

Comfortable beds and mattresses with water-repellent covers should be provided. There is a trend toward eliminating springs, and foam-rubber mattresses are being placed on plywood frames. From a health point of view, this practice is to be recommended, and it lends itself to simple housekeeping.

Wherever possible, the beds should be built into the unit, and movable furniture should be kept to a minimum. Each camper should be provided with a storage area for clothing, suitcases, and other personal items. Single beds are recommended. Double-deck beds are sometimes used, but they increase problems of supervision and are extremely dangerous for young children. The toilet rooms should be equipped with mirrors and sinks sufficient for the morning and evening rush periods.

If the lighting in the sleeping areas is to be subdued in order to create a more restful atmosphere, then wall lights should be provided for reading.

If possible, a fireplace should be included in the lounge area. This will add considerably to program possibilities during inclement weather. What a fireplace can add to the general atmosphere of a building far outweighs its cost.

HEALTH LODGE

The health lodge should be located near the food-preparation area. This location will permit the delivery of food to the patients when necessary. It also assures proximity to a good service road for an ambulance or other necessary vehicle.

The facilities in the health center should include a waiting room, an isolation room, an examining room, and two wards of at least two beds each (see Figure 46). Two wards are necessary because outdoor education programs are usually coeducational. The bath should include a tub as well as a shower, and the isolation room should be equipped with separate toilet facilities.

The nurse's quarters should be attached to the health lodge and should include a living room, a kitchenette, and a bedroom. Although the health lodge should be fully equipped with first-aid equipment and medical supplies, it must be remembered that this building is intended as a supplement to the hospital which will serve the center and in no way should attempt to duplicate hospital facilities.

STAFF QUARTERS

In large outdoor education centers, two types of staff quarters are needed. The first is adequate housing with modern conveniences for permanent staff. The second is suitable housing for visiting teachers and resource person-

OUTDOOR EDUCATION AREAS AND FACILITIES

nel who will be working in the program. All staff quarters should be comfortable and attractive, and should include at least a bedroom, a snack kitchen, toilet facilities, and a comfortable living room. These facilities should be so designed as to accommodate both sexes.

MAINTENANCE BUILDING AND SHOP

The maintenance building and shop should include: a carpenter shop; storage areas for all building materials; garage space for trucks, tractors, and other vehicles; a stall for the greasing, servicing, and maintenance of equipment; and space for construction and repair.

RECREATION LODGE AND LIBRARY

Although the program is basically one that features outdoor activities, it will, upon occasion, be necessary to have an indoor area large enough to house the entire camp population. Such a building should be equipped with adequate lighting facilities and a large fireplace. It should be well insulated and heated. It is also suggested that a separate room to serve as the library for the outdoor education center be included. The need for a library is self-evident, since many questions will be raised in the field and left unanswered until further research and exploration can take place in the center library.

TRADING POST

Although many centers and camps incorporate a small store into the corner of the dining room or the administration building, a separate building might better serve this function, thereby relieving congestion and confusion in areas that might be serving other purposes. The trading post can be designed so that half of the building is used to dispense campcraft equipment, such as axes, compasses, fishing rods, snowshoes, and cross-country skis.

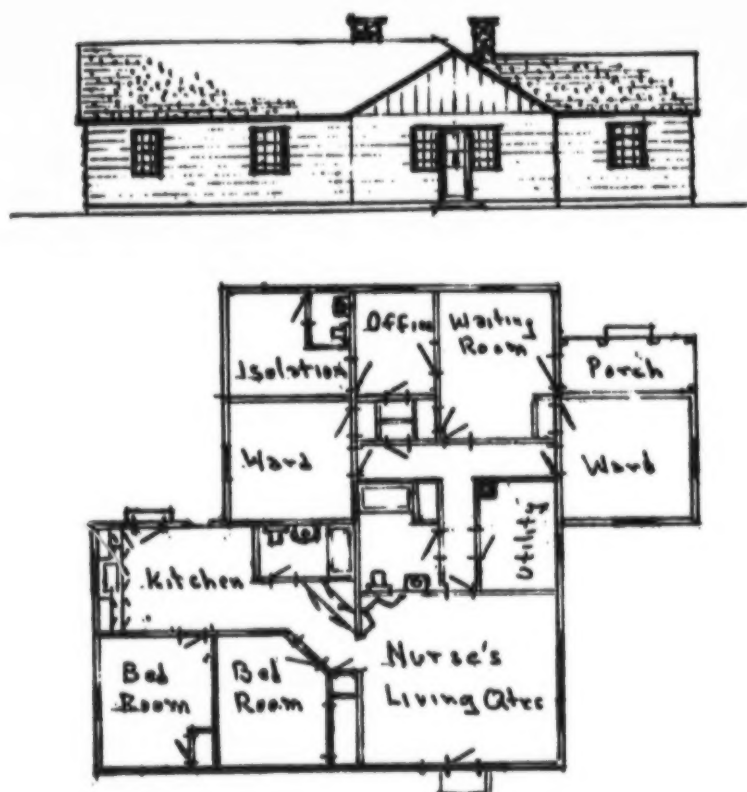


Figure 46
Health Lodge

CRAFT SHOP AND SCIENCE CENTER

Every outdoor education center should have one building or one section of a building set aside for nature crafts. Most of the activities will take place in the out-of-doors. However, it is necessary to have an area where tools and materials may be stored and where classes may continue in inclement weather. The other section of this building may serve as a science center, where telescopes, microscopes, butterfly nets, and other equipment used in a nature or science program might be stored. The center might also have a few exhibits to stimulate the interest of the participants and excite their curiosity. It is well to have a series of nature trails, originating somewhere near the science center.

OVERNIGHT CAMPING FACILITIES

Whenever possible, participants in an outdoor education program should be encouraged to move out of the buildings and participate in an overnight living experience in a tent or similar temporary shelter. A unit of covered wagons not only adds romance to the overnight experience, but also provides for many stimulating discussions on the western migration of early pioneers (see Figure 44). Under such circumstances, the children are actually reliving a historical experience. A reconstructed Indian village serves a similar purpose. Other overnight units, which may not have the educational value of the two mentioned but which also prove to be most enjoyable, are Adirondack shelters, tree houses, and Alpine villages where A-frames with appropriate motifs are used.

Of prime consideration in any overnight camping area are the general features of the land. Regardless of the type of shelter used, every overnight unit should be equipped with running water or other water supply, toilets, a cooking area, and a small council ring.

UTILITIES

All camps must be equipped with utilities in order to function. These utilities are especially important for centers that plan to operate twelve months a year. Most outdoor education centers operate most of the year and must have adequate water, electrical service, and sewage disposal.

WATER

Every resident outdoor center must have safe and adequate water approved by the State Department of Health. In the absence of State Department of Health guides, the U.S. Public Health Service should be consulted. A storage reservoir should be constructed, with a minimum capacity of 10,000 gallons for a camp serving 150 participants. This amount represents a minimum supply for one day.

SEWAGE DISPOSAL

The general terrain and soil conditions will dictate the best type of sewage-disposal system to be developed. Under normal conditions, the system will include a septic tank, dosing chamber, and tile field. In some sections of the country, a sewage lagoon has proved to be most effective if there is sufficient space to place it the required distance from any living area.

Flush toilets are highly recommended for the established living units, while pit latrines may be used for overnight and outpost living units. All sanitary facilities should be constructed in accordance with the regulations of the State Department of Health. Special county, city, or U.S. Forest Service requirements may also govern construction. A com-

petent engineer should be consulted on the construction of any disposal system. He should be able to advise on regulations which exist in a given area. The final plans and construction must be approved by authorized inspectors.

ELECTRICAL SERVICE

The electrical distribution system for the outdoor education center should be designed to meet the maximum anticipated use. It is necessary to consult the master plan in order to determine any possible future expansion. Wherever possible, all electrical lines should be placed underground for considerations of aesthetics and safety.

HEATING SYSTEMS

The type of heating system chosen should depend on the facilities to be heated and the geographic area in which the center is located. The type of fuel used may depend upon heating needs and local prices. Fuel oil and liquid propane have been widely used. However, any center under construction at this time might consider the use of electric heat. Although the initial construction cost may be high, there are many advantages in efficiency, maintenance, and safety.

FIRE-PROTECTION SYSTEMS

The need for fire protection is self-evident. Every cabin and every building should be equipped with a water-type fire extinguisher. In addition, there should be frostproof fire hydrants located strategically throughout the camp, with sufficient lengths of hose to reach all buildings in a given area. If possible, large buildings should be equipped with a sprinkler system.

All buildings accommodating more than ten participants should be equipped with two means of egress. All outside doors should swing in the direction of egress. All highly-inflammable material should be avoided in the construction and furnishing of buildings.

PROGRAM FACILITIES FOR A RESIDENT CENTER

The following types of program facilities may be desirable for a resident center: nature-study demonstration areas; weather stations; nature trails; council rings; rifle ranges; target archery; field archery; boating and canoeing; swimming areas; campcraft areas; and winter activity areas. Specifications for these areas and facilities may be found elsewhere in this **Guide**.

SPECIALIZED COLLEGE OR UNIVERSITY OUTDOOR CENTERS

During the summer months, the resident outdoor education center of the college or university may be used for a variety of programs. It is possible to utilize the facility as a demonstration summer camp for children, where college students working as counselors or activity specialists may earn college credit in the areas of outdoor recreation, natural science, social science, or the fine arts. The facility may also be used as a rehabilitation center for special education.

In addition to the resident outdoor education center, many colleges and universities operate other types of outdoor centers, such as forestry camps, geology camps, biological field stations, music camps, and camps for the socially maladjusted. The educational potential of all such outdoor facilities should, wherever possible, be explored and utilized as part of the institution's total outdoor education complex.

ALUMNI FAMILY CAMPS

Another trend in utilization of the outdoors by colleges and universities is the development of alumni family camps. In many institutions, the alumni association, in cooperation with the college or university administration, will operate a family camp during the summer months for alumni and their families.

Alumni family camps fall into two categories: the unorganized; and the organized or structured camp. In the organized camp facility, cabins are provided for the families, and central dining facilities are usually provided. The program features outdoor recreation, which includes such activities as horseback riding, sailing, canoeing, boating, and swimming.

In order to reduce the cost of such a program for the participant, some consideration should be given to including a kitchenette in each of the living units. If this plan is followed, a central dining hall could be eliminated. It is recommended that each of the cabins be equipped with toilet and shower units rather than the centralized sanitary facilities such as might be found in the resident outdoor education center.

In the unorganized alumni family camp, tent sites, trailer sites, or some kind of primitive shelters, such as Adirondack units, are provided in place of cabins. This type of facility appeals to those who enjoy rugged outdoor living and appreciate the low cost. Either outdoor cooking facilities or centralized eating facilities may be used, although outdoor cooking by individual families seems to be more popular.

TENT SITES

The requirements for a tent site are: level ground with sufficient space to pitch a large family-size tent; a fireplace or cookout area; a table with benches; toilets; a parking area; and running water. In order to avoid overcrowding, there should be no more than four to six tent sites to an acre. So that traffic may be controlled, one-way roads through the immediate tent-camping area are recommended. Running water should be available within two or three hundred feet of each camp site. If flush toilets are used, they should be placed no more than 300 feet from the living areas. It is desirable to provide showers and washtubs in a central location that may be utilized by several tent units.

ADIRONDACK UNITS

For the family that cannot afford the investment in a tent, an Adirondack unit should be provided. The requirements for Adirondack shelters are similar to those for tent sites.

TRAILER SITES

It is recommended that trailer sites be somewhat removed from the tent-camping areas. The most adequate trailer sites are crescent-shaped. With this design, the car and trailer may enter at one end and park at the top of the crescent; and, when ready to leave, continue out to the access road without having to turn around. The small area of land filling the crescent should provide sufficient solitude and isolation to achieve the atmosphere required of any camp site. In addition to a fireplace, table, and sanitary facility, electrical outlets should be provided, with coin-operated units. The more elaborate trailer sites may include

water and sewage hookups. However, many times the additional cost of installing the hookups is not warranted. A survey on the amount of use the sites receive is necessary before funds are allocated for this type of trailer-site installation.

The program for the organized family camp is very similar to that for the resident outdoor education center, with a great deal of emphasis on the teaching of outdoor recreation skills. In the unorganized camp program, facilities are provided where the family may elect to participate as a family unit without the benefit of formal instruction.

CONFERENCE AND WORKSHOP CENTERS

A resident outdoor education center owned and operated by a college or university can be designed to serve a number of functions in addition to teacher and leadership preparation. Off-campus conference centers are becoming increasingly popular and are particularly effective as "change agents" in continuing education. With some modifications that will make the facility more adaptable for adult groups, the resident outdoor education center can serve many groups for in-service education. The growing popularity of conference centers in outdoor settings can be attributed largely to the better human relationships and understanding that occur in such informal situations, and the resultant effectiveness of education. Another factor is the ability to provide working conferences with opportunities for outdoor recreation. Not the least of the considerations is the additional income from a conference center which will help defray the operational costs of the installation. The provision of rooms for two to four people instead of large dormitories, adequate toilets and baths, a few conference rooms, and efficient food service will make a successful combination of an outdoor education facility and a conference center.

College outing clubs and other undergraduate and graduate groups may wish to utilize the facilities of the center for outdoor recreation on weekends and during college or university vacation periods. Such possible use should be considered in the development of the master plan for the center.

OUTDOOR LABORATORIES

The term "outdoor laboratory," as used herein, refers to any outdoor area—land or water—that is utilized for outdoor education on a day-use basis. Outdoor resident centers, which have been considered earlier in this chapter, may also be used as outdoor laboratories.

The outdoor laboratory may consist of only a few acres or hundreds of acres. It may be largely natural or it may be horticultural. It may have limited facilities designed to serve one specialized interest, or it may have extensive facilities designed to serve a wide variety of interests. Colleges and universities will generally use such areas as laboratories for learning for college students, or as experimental areas for children, with opportunities for leadership and observation by college students and faculty members.

The following are some of the developments possible in outdoor laboratories:

- Wooded areas with experimental plantings, seed germination beds, trails, and similar developments
- Wet areas with ponds, bogs, marshes, streams, seashores, and lakeshores (Special piers, bridges, walkways, and pathways are sometimes developed to make possible better study of water life.)
- Nature trails ranging in materials presented from technical data on local ecology to simple identification

- Plot study areas that may involve special studies of natural communities, such as succession studies and special habitat studies
- Horticultural and garden areas that may be used for the study of horticultural plants or for the development of children's garden programs under practice leadership

The outdoor laboratory can be used by many college or university groups. Classes in ornithology may find it a spot for field observation. Classes in botany, zoology, geology, horticulture, agriculture, teacher education, conservation, and outdoor recreation are only a few that might make use of a good outdoor laboratory.

OUTDOOR LABORATORY INTERPRETIVE CENTER

It is recognized that the outdoor laboratory is intended as a spot for direct experiences with the world of nature, but a building may serve as an important aid in such education. It may range from a small one-room structure, intended primarily as a bad-weather shelter and storage spot, to a comprehensive building similar to a community nature center. The following features might be included in the building, depending upon the needs of the particular institution:

- Museum-type displays
- Library
- Meeting rooms with projection equipment, blackboards, etc.
- Laboratory work space
- Storage facilities for tools and equipment used outdoors
- Simple cooking and refrigeration equipment for day-use groups
- Toilets

In addition to use by classes, an outdoor laboratory would receive informal use by many students interested in increasing their knowledge about the outdoors.

FARMS

Farms and agricultural lands are frequently among the holdings of colleges and universities, having been obtained through gifts or acquired for educational purposes and research. Such facilities offer unique possibilities for field study, professional preparation of teachers and youth leaders, and recreation. These farm lands increase in importance as land areas and farm life become less prevalent.

A farm setting adds materially to programs of outdoor education, especially if located in or near urban areas. Farm museums, pioneer farms, and demonstrations of modern agriculture may be developed and are added values to farms owned by colleges and universities.

SERVICE FACILITIES FOR DAY-USE AREAS

Facilities for meetings and for the comfort of various-size groups are an important part of outdoor laboratories. These facilities include toilets and simple facilities for food service. Most groups using the areas will probably bring picnic meals, but there is generally a need for refrigeration and for shelter in case of rain. An open-sided shelter is satisfactory for summer use, but for winter use it would be desirable to have an outdoor meeting room with tables, heat, and very simple cooking facilities.

Outdoor picnic areas with fireplaces usually add to the appeal of day-use areas. Council rings or outdoor meeting spots for classes are also desirable.

OUTDOOR SPORTS AND SKILLS COMPLEX

While many outdoor education and outdoor recreation activities may be conducted on a single site, there are situations where a cluster of sites and facilities is owned and operated by the college or university. One of these units may be an outdoor sports and skills complex, which should complement the other types of areas and facilities described in this chapter, and should also serve specific programs, many of which fall within the scope of the schools and departments of health, physical education, and recreation.

The areas and facilities that may be included in an outdoor sports and skills complex are briefly described herein. Several of these areas and facilities should be duplicated on the outdoor recreation center and campus. Specifications and detailed descriptions are omitted, since they may be found in the publications of agencies that have responsibilities for, and controls over, specific activities. (See the list of agencies in Appendix F.)

ARCHERY

Target archery may be taught indoors or outdoors, depending on the season of the year and the available space. To extend the opportunities for this growing sport, it is recommended that there be outdoor ranges for instruction and recreation, as well as indoor space and equipment (see Chapter 6). Space to insure safety can be provided in a variety of outdoor settings, including the outdoor sports and skills complex, with adequate provisions for necessary equipment, such as targets, mats, nets, or other types of backstops (see Chapter 8). Recommendations concerning specifications may be obtained from several sources, such as the National Archery Association and the American Association for Health, Physical Education, and Recreation (see Appendix F).

Provision should be made for a field-archery range in the outdoor sports and skills complex. A course of 14 or 28 targets in a partially-wooded area would be appropriate, as would a junior range of 7 targets. Field courses can be planned according to the unique features of the land, adding to the adventure of the sport. Information on specifications is available from the National Field Archery Association (see Appendix F).

Archery games such as clout, roving, and archery golf can be conducted in large playfields, outdoor recreation areas, and golf courses with little added equipment.

The inclusion of archery in the Olympic games, and the growth of bow hunting and bow fishing are stimulating the teaching of competitive and recreational archery. Therefore, the planning for space and equipment for this sport is becoming increasingly important.

BOATING, CANOEING, SAILING, AND OTHER WATER ACTIVITIES

The availability of natural lakes, rivers, and water impoundments in many parts of the country makes it possible to include a variety of water activities in physical education and recreation programs. Increasing numbers of colleges and universities now have, or plan to acquire, properties that will provide opportunities for instruction and recreation in water activities. Information concerning specifications for facilities, equipment, and safety features is available from several sources, such as the American National Red Cross and the trade associations concerned with boating and sailing, skin and scuba diving, and water skiing (see Appendixes F and K).

NATURE CRAFTS AND CAMP-CRAFT SKILLS

A portion of an outdoor sports and skills complex should be set aside for creative arts and crafts dealing with native materials, camp crafts, orienteering, compass games, outdoor cooking, and outdoor living. Simple structures for crafts and outdoor activities may be provided as needed for inclement weather and for the housing of equipment.

CASTING AND ANGLING

Open level spaces and casting platforms (where there is water) are needed to provide instruction in casting and angling in an outdoor sports and skills complex. Information concerning instruction, equipment, and competition for casting may be obtained from the American Casting Association and the American Association for Health, Physical Education, and Recreation (see Appendixes F and K).

SHOOTING AND GUN SAFETY

Outdoor ranges for rifle, shotgun, trap, and skeet shooting should be provided in the outdoor sports and skills complex when space and safety requirements permit (see Chapter 20). Complete information concerning the construction of outdoor ranges may be obtained from the National Rifle Association (see Appendix K). The Association has a complete, modern shooting range equipped with the newest devices for safety and acoustical treatment. These devices are available for observation and research in the construction and maintenance of shooting ranges for rural and urban areas.

WINTER SPORTS

Increasingly, colleges and universities are providing facilities for instruction and participation in such winter sports as skiing and tobogganing (see Chapter 20). Detailed specifications should be studied before deciding on ski slopes and tows, snow machines, and toboggan slides. These specifications may be procured from trade associations, private contractors, and park agencies. Other winter sports, such as ice skating, need special facilities such as rinks and warming houses (see Chapter 16).

CAMPUS OUTDOOR RECREATION FACILITIES

The increased interest of the American public in outdoor recreation finds its counterpart on college and university campuses. Many institutions are, therefore, making special provisions for outdoor recreation opportunities for students during their leisure. It is recognized that what a particular college or university endeavors to develop is contingent upon what is already available through public and private agencies, as well as the environmental possibilities near the institution. Developments may range from picnic areas and outdoor meeting spots on the campus to special areas a considerable distance away.

Following is a list of some possible campus facilities for outdoor recreation, many of which may be found in various combinations:

- Swimming beaches
- Boating areas, including provisions for sailing, canoeing, and water skiing
- Fishing facilities

OUTDOOR EDUCATION AREAS AND FACILITIES

- Picnic and cook-out areas, constructed to give opportunities for campus clubs or classes to conduct such activities as steak fries and clam bakes (Fireplaces, picnic tables, and water are desirable. A picnic shelter may be needed if the area is to be used in inclement weather. See Chapter 20.)
- Primitive camping facilities for groups that may wish a rugged outdoor experience
- Hiking trails
- Trails for groups interested primarily in natural science, such as botany, ornithology, and geology
- Riding stables and bridle trails
- Amphitheaters for outdoor dramatic productions, musical events, or campfire programs
- Meeting facilities

- Winter sports areas with ski tows, ski runs, skating areas, etc.
- Residence accommodations (These are not usually offered if the recreation area is near the campus. Many institutions maintain areas for students and faculty at more distant lakeshores, seacoasts, or mountains, and overnight or weekend accommodations are needed. They may consist of dormitories, small cottages, cabins, ski lodges, or tent and trailer spaces.)

Sometimes campus organizations such as sailing clubs, ski clubs, or natural science clubs may develop facilities to meet their particular interests. In other cases, the student unions assume the responsibility for developing the outdoor recreation areas as part of their programs. In still other cases, the college or university administration takes the lead.

SELECTED REFERENCES

American Camping Association, *Camping Standards*. Martinsville, Ind.: The Association, 1966.

Conservation of the Campsite. Martinsville, Ind.: The Association, 1960.

Athletic Institute, The, *Campcraft Series I. Color-sound 35mm Film Kit, Instructor's Guide and Student Handbook*. Chicago: The Institute, 805 Merchandise Mart, 1965.

Nathans, Alan A., *The Handbook of Camp Maintenance*. New York: Association Press, 1959.

National Association of Biology Teachers (Richard Weaver, ed.), *Manual for Outdoor Laboratories*. Danville, Ill.: The Interstate Printers and Publishers, Inc., 1959.

Outdoor Recreation Resources Review Commission, *Outdoor Recreation for America*. Washington, D.C.: United States Government Printing Office, 1962.

Shomen, Joseph J., *A Nature Center for Your Community*. Information Education Bulletin No. 1. New York: National Audubon Society, 1962.

Smith, Julian W.; Carlson, Reynold E.; Donaldson, George W.; and Masters, Hugh B., *Outdoor Education*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963.

Stapp, William B., *Integrating Conservation and Outdoor Education into the Curriculum*. Minneapolis: Burgess Publishing Company, 1965.

Young Men's Christian Association, *Developing Camp Sites and Facilities*. New York: Association Press, 1963.

Young, Paul R., *Elementary Lessons in Gardening*. Columbus, Ohio: The National Garden Institute, 1953.

Chapter 16

ICE-SKATING FACILITIES

Artificially-frozen ice-skating facilities are replacing naturally-frozen skating areas in many colleges and universities. Artificial rinks, either indoor or outdoor, provide smooth and hard ice in relatively-moderate weather. With the advent of mechanical freezing, the skating season has been extended far beyond the 20- to 60-day natural-ice season. With artificial-ice equipment, the season may range anywhere from five to twelve months, depending on climatic conditions and the design and construction of the facility. This does not mean that natural-ice rinks have gone out of style, but it does mean that artificial rinks are supplementing natural rinks wherever local interest and available funds make it possible.

Ice surfaces for colleges and universities are of four types:

- Natural-outdoor: not very practical or dependable except in extreme northern states, but low in cost
- Artificial-outdoor: usable up to 50 percent of the time five months per year in temperate or colder climates, but frequently out of use because of the hot sun, temperature rises, snow, rain, wind, litter, or the like
- Artificial-covered: only usable 90 percent of the time up to six months per year
- Artificial-enclosed: usable 100 percent of the time up to 12 months per year if the insulation, heavy-duty machinery, and ventilating, air-conditioning, and temperature-control equipment are properly engineered into the total structure

The enclosed ice arena is a practical physical education-athletic facility for use during the entire school year.

The rink should be located near other physical education and athletic areas, but particularly close to parking facilities. Normally, it is housed in a separate building or in a separated portion of a field house. The desired room temperature of the rink varies considerably from that of other indoor areas. When the temperature rises above 55°F, complex problems of ice condition, ice-making costs, and humidity are encountered.

A major item to consider in locating the ice is the nature of the soil upon which the ice will be built. Unless the soil is well drained and free of excessive moisture, "heaving" of the ice or concrete can result. Mechanical freezing can penetrate to a depth of eight feet or more. Therefore, a careful soil analysis is a primary factor in determining the site of the ice rink.

In the college or university program, an ice facility may serve for skating instruction, recreational skating, competitive hockey, dance and figure skating, and curling. Some institutions have three separate ice areas—one main area for hockey, instruction, and recreation; one for figure skating; and one for curling. The ice qualities are different for each area. Skating ice and curling ice are so different they are not interchangeable for use. The main arena can accommodate dance skating when not being used for recreational skating.

After the function of the ice facility has been determined, considerable planning is necessary to insure an efficiently-operated facility. This can best be done by engaging an experienced designing engineer who has a number of successfully-operating rinks to attest to his ability. Some feel that the engineering and supervision of construction should be the responsibility of the same person to insure a quality facility. In enclosed rinks, the building housing the ice should be engineered and planned concurrently and complementary with the ice-making machinery and system.

Other areas that must be considered in planning the total space are locker and shower rooms, the skate rental and sharpening area, space for putting on skates, the warming area, toilet rooms and cloak and book-rack room, equipment storage and utility areas, and a storage area for ice-maintenance machines. A pit with a drain into which scrapings from the ice may be dumped is a necessary installation in enclosed ice arenas. It should be close to the ice and at the same level.

An ice area designed for hockey should be a minimum of 85' x 185' (85' x 200' preferred), with rounded corners and a wall (dasher board) which meets the specifications for competition. For instruction and recreational skating, it is generally agreed that the necessary area per skater is 30 square feet. Thus, a rink the size of 85' x 185' would accommodate 524 skaters.

SPECIAL CONSIDERATIONS FOR ICE HOCKEY

For intercollegiate hockey, the ice (rink) surface must be at least 85' x 185', though 85' x 200' is preferred. It must be enclosed with a wooden wall (dasher board) which has rounded corners and is 4 feet in height. A two- to four-foot screen above the dasher board affords protection to the spectator and keeps the puck in play. Strong glass or plexiglass screens are excellent but are apt to cost considerably more. The dasher board should be covered with a tough kick board eight inches high at ice level to protect it from being marred and punctured by skates. The dasher board with screen must be strongly constructed in order to withstand the shock of skaters bumping into it. Planners and architects should consult the official hockey rule book for rink specifications and suggested design.

There should be at least two team locker rooms with attached shower rooms, plus a change room with shower for officials. If a competitive hockey program is planned, sectioned locker rooms to accommodate more than two teams simultaneously would be desirable. An athletic training room is recommended. If entrances open to the outside of the arena, locker rooms can frequently serve other athletic teams when hockey is not in season.

Other special provisions for intercollegiate competition include: (1) hockey goals and their storage; (2) a scoreboard; (3) provisions for players' boxes and penalty boxes; (4) a public-address system; (5) high-intensity lighting; (6) a press box; (7) provisions for radio and television; (8) ticket booths and admission turnstiles; (9) adequate

public rest rooms; (10) public telephones; (11) concession stands; (12) a scorer's and timer's box; (13) hot water for ice-maintenance machinery; (14) water outlets; and (15) administrative units.

Seating for spectators at hockey and ice shows is a prime consideration. Space under bleachers may accommodate some facilities cited above. The provision of high-quality music for both skaters and spectators is difficult since acoustics over ice presents a special problem.

SPECIAL CONSIDERATIONS FOR CURLING

Curling ice is different from skating ice in both texture and hardness. Neither ice is suitable for both skating and curling. Curling requires ice which is very level, and textured (pebbled) to accommodate the accurate sliding of the 40-pound rocks which are delivered skillfully from one end of the ice to the other. The game's full possibilities cannot be realized without good ice. Such ice requires good equipment, and pride, patience, and competency on the part of the ice-makers.

Curling ice in covered or inside rinks is more contributory to the game than that which is outside. Except in extremely-cold climates, it is not practical to attempt to provide curling ice without artificial refrigeration.

The room accommodating the ice should be kept cold—heating is not necessary or even desirable. When temperatures exceed 50°F, problems of fogging, dripping, and "greasy" ice are apt to be encountered. Resurfacing the ice may be necessary several times a year, but "pebbling" may be necessary several times a day. Pebbling is accomplished by sprinkling droplets of warm or hot water over the ice surface from a portable canister equipped with a nozzle. In the planning and construction, provision should be made for keeping the ice clean and free from dirt or grime.

The curling-area size is determined by the number of sheets (lanes) desired, a sheet being 14' x 138'. Two to four sheets normally constitute a college or university curling rink. Thus, an area of 62' x 150' would accommodate four sheets, with a border of four feet on each side and six feet on each end to accommodate a concrete or wooden deck around the rink. Each curling sheet can accommodate eight persons in a curling match.

Little playing equipment is needed in curling except the rocks and brooms. Broom storage racks or closets and an official scoreboard at the end walls are required for the area. Good artificial lighting (100 footcandles) which does not cast shadows is recommended. "Cold" lighting helps preserve the ice and its condition.

Curling ice should be maintained at a temperature of 24° to 26°F, in contrast to skating ice which requires 10° to 15°. Outside windows should be omitted, as well as any conditions that produce drafts or uneven temperature changes. A minimum number of entrances should be installed. Electrical outlets and hose bibbs should be provided in the arena area. Light colors should be used for walls and ceilings.

Spectator facilities are rarely needed in curling arenas, but an elevated lounge from which games can be viewed through insulating glass is a feature which has merit if costs are not a major factor. Change, locker, or storage rooms can be located under the lounge if desired.

INDOOR ARTIFICIAL-ICE RINKS

If the building is constructed for year-round use, it must be especially well insulated throughout and there must be adequate refrigeration capacity for use during the summer

months. While hockey interest may diminish during the summer, skating instruction can continue, and recreational skating is a continuing pleasure for many. Also, figure and dance skaters will continue to practice. Extremely-careful thought must be given to humidity and temperature control to minimize fogging, condensation, and soft ice. (See Figures 47 and 48.)

The refrigeration system is of prime importance, and a number of choices can be made in its design. Among them are: (1) type of engine room; (2) extent of automatic control; (3) number and size of compressors; (4) type of power supply; (5) number of brine pumps; (6) type of heat-rejection system; (7) type of refrigerant; (8) type of brine; and (9) type of floor construction. Inexperienced planners should not attempt to design rinks. The ice-making engineer should be involved extensively in the preliminary planning and throughout construction.

ENGINE ROOMS

For the past few years, there has been a trend toward the purchase of engine rooms which are assembled in the factory and installed as a complete unit on the job. These engine rooms have replaced the "site-built" engine rooms, which require greater space and are more expensive. It is probably easier, however, to maintain and repair equipment in a site-built engine room.

AUTOMATIC-CONTROL SYSTEMS

Machines may be automatic or manually controlled. Automatic safety devices may be required by codes governing this type of installation. The slight additional cost for fully-automatic operation may be offset by the savings effected in salaries. Automatic controls can start the compressors when brine temperatures start to rise, and shut them off when they fall. The starting temperatures of the compressors can be staggered for a more economical use of power. In addition, a brine-pump control can be set to stop brine circulation if the air temperature falls below the brine temperature, a condition that occurs often in the colder climates.

To illustrate this choice, assume that an outdoor ice rink of 85' x 185' needs 150 tons of refrigeration to maintain the rink surface at near peak demand. This refrigeration can be obtained with one 150-ton compressor, two 75-ton compressors, or three 50-ton compressors. When sunshine or rising air temperature causes the brine temperature to rise above the level set to start the chilling process, the compressors will start to work. In the case of one compressor, maximum power will be utilized, and when electricity is the power source, maximum demand rates will be charged even though a minimum of refrigeration is required. This expense is greatly reduced when two compressors are used, and a still greater saving is effected when the capacity is divided among three compressors. The greatest power-cost saving occurs during long periods of cold weather when minimum refrigeration is required. Some motors are designed for four or more power levels to lessen electrical costs.

In order to assure continuous operation, there should be two compressor systems, each with the capacity to provide the necessary refrigeration. They should be used alternately, of course, but with two, a standby is always available in case of failure of one of the systems. Thought should be given to installing equipment which does not require tending by a licensed engineer.

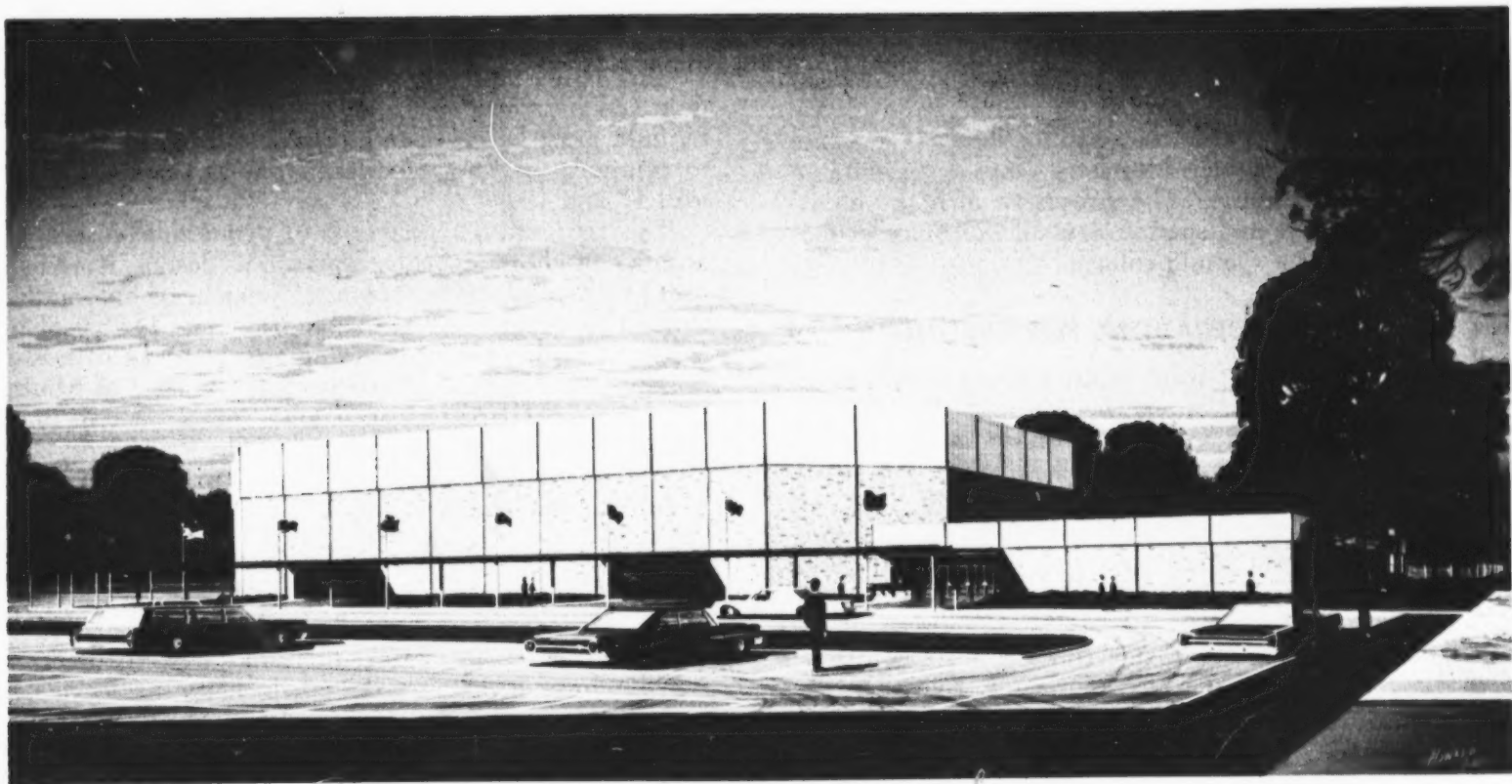


Figure 47
Ice Arena, Bowling Green State University

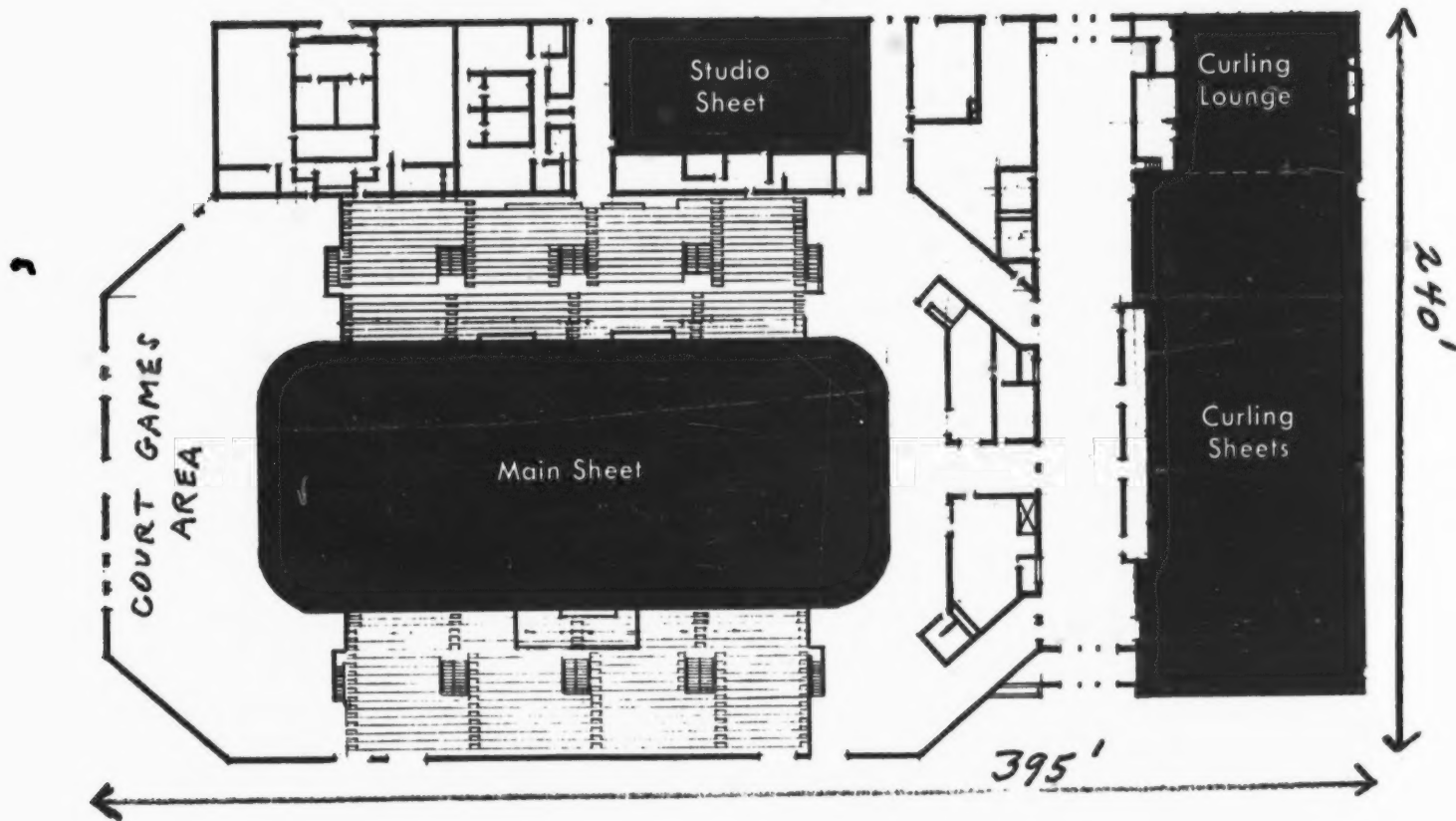


Figure 48
Floor Plan of Ice Arena, Bowling Green State University

POWER SUPPLY

The refrigeration plant may be operated by either electricity or natural gas. Natural-gas engines may be more expensive to install, but may operate at considerably less cost. Gas engines can be put under service contracts that assure a life expectancy comparable to that of electric motors. Gas engines also provide heat energy that can be used for space heating through a heat-recovery system.

BRINE PUMPS

The brine pump is the heart of the refrigerating process. When it breaks down, everything stops and the ice surface is at the mercy of the sun, weather, and temperature during the period of repair. Some brine pumps have quick-repair features which can shorten the time the system is out of operation. For all practical purposes, the breakdown time due to brine-pump failure can be eliminated by building two or more brine pumps into the system. With this arrangement, other pumps will give standby service in case one fails.

HEAT-REJECTION SYSTEMS

Heat removed from the ice must be eliminated in the refrigeration process. This is accomplished by the condenser, which removes heat from the refrigerant. The condenser may use either cold water or the evaporation principle to accomplish heat rejection. An evaporating condenser costs more initially, but if water is an item of expense, it will be cheaper to operate. Many competent rink designers insist on evaporating condensers where city water alone must be used for cooling. The refrigerant, which has absorbed heat in cooling the brine, must be cooled in this cycle of operation. This is done by circulation through coils exposed in the air. When the air temperature alone cannot cool the refrigerant to the proper level, water is sprayed on the coils, and fans blow air over the wet coils to cause evaporation. This process provides the necessary additional cooling.

REFRIGERANTS

Several refrigerants are available. Ammonia and Freon 22 are the most common, but other trade-name products are worth consideration. Although operation with ammonia has been efficient, it is both toxic and explosive, and, for these reasons, the trend has been toward the use of Freon 22 and other refrigerants which are neither toxic nor explosive.

There is little difference in the initial cost of refrigeration machinery designed for either ammonia or Freon gas. The cost of the refrigerant does differ, however, with Freon costing about five times as much as ammonia. This cost is equalized since an ammonia system will use nearly five times the refrigerant necessary in systems using Freon gas. Since Freon gas is odorless, leaks in the system may go undetected and expensive replacement of refrigerant becomes necessary. This is not the case with ammonia. However, safety is an overriding factor that dictates the preference of Freon for ice-rink refrigeration. This does not mean that there are not applications where ammonia should be recommended, but local laws should always be consulted before using ammonia. In using Freon, some operators add another gas that has a detectable odor.

TYPES OF BRINE

Calcium-chloride brine is used in most ice-rink refrigeration systems. It is not expensive, but it is highly corrosive

and must be closely checked. It is possible to purchase salt (for brine) that contains a chromate which acts as a rust inhibitor. This inhibitor does not last long, however, and additional chromate must be added from time to time to maintain the rust-inhibiting factor. Although corrosion is reduced by the chromate, it is not eliminated. There is a growing trend toward the use of ethylene glycol or methylene alcohol as a brine. Once stabilized, these brines usually require only infrequent checking.

FLOOR CONSTRUCTION

The following types of floor construction are used in building artificial-ice rinks:

- Steel pipe in post-stressed concrete
- Steel pipe in reinforced concrete
- Open steel pipe (or in sand)
- Open plastic pipe (or in sand)

These choices are listed in the order of their cost, with the most expensive listed first. In addition to the choices listed, aluminum-finned tubes have recently made their appearance as piping for rink floors.

The newly-developed construction using steel pipe in post-stressed concrete floors is the most costly of the choices listed, but the least likely to develop cracks or heaving. It is reliably calculated that a post-stressed floor can endure, if necessary, at least twice as much frost heaving as conventional reinforced-concrete floors.

Sand-based rinks have been purported to have the following advantages: cheaper initial cost; economy of operation; avoidance of cracks; easier repair; level surface; and less possibility of heaving. However, their use for other sports (e.g., tennis and court games) in the off-season is not feasible. Concrete-base rinks, though more expensive, may have advantages worth the extra costs.

Plastic pipe is lightweight and easy to handle, especially in portable and take-up installations. However, plastic acts as an insulator and does not transfer heat from ice to brine as rapidly as does steel. Plastic is cheaper than steel, but may not last as long. The main preference for steel seems to be the efficiency in maintaining ice temperatures.

The floor pipes are connected to headers attached to the supply and return lines. There are two basic header designs, each with several variations. One system employs a header at each side of the rink, or at each end, with the floor piping joined to these headers at each end. The advantage of this design is that ideal uniformity of ice can be maintained. The disadvantages are that it is the most expensive design, and temperature-expansion variables can be a problem. In the second design, both headers are at the same side or end, and the rink grid surface is made up of hairpin pairs of pipes. This is the most common modern design. Another recent design is one in which the headers bisect the center of the ice.

Grid-construction practices in building rink floors call for especially good drainage around foundation footings to cut off ground-water seepage into the floor area. A common practice is the installation of a slip-joint consisting of two or more dry, lubricated membranes between the grid and foundation slabs of concrete. The concrete slab that encases the grids should be poured in one continuous operation which will permit the grid slab to contract or expand as a unit rather than in sections. The return header should be at a slightly higher elevation so there can be no trapped air in the cross pipes. The floor should be pressure-tested after construction, and after assembly if it is a take-up rink. This will eliminate brine leakage due to faulty assembly.

SEMIENCLOSED OR OUTDOOR ARTIFICIAL-ICE RINKS

The ice-preparation procedure for artificial ice is essentially the same whether the rink is open, covered, or enclosed.

In outdoor and semienclosed rinks the air temperature is much more variable and demands some additional consideration in preparation and care of the ice. The length of season is greatly restricted when the rink is not enclosed or covered. Also, the unenclosed rinks present problems relative to: (1) the size and type of warming area; (2) lighting; (3) traffic control and ticket collection; and (4) dependable usage and scheduling.

Although a majority of outdoor rinks have no cover, some covers are available which are of value in protecting and preserving the ice. Netting is available to provide a sunshade on bright days. It is drawn across the rink on high cables as a curtain, greatly weakening the melting effect of sunlight. An inflated bubble of fabric material has been used as a rink enclosure, but its effectiveness has not been established.

Permanent covers may be constructed of steel, aluminum, concrete, and wood. All of these types of covers reduce ice-freezing costs and snow-removal expense. New building and engineering techniques are making the completely-enclosed and temperature-controlled rink practical and serviceable as a college or university facility for nine months of the year or longer.

Whether the skating area is open or enclosed, a warming room or skate-changing area is necessary. This area contains a maximum number of benches and often has checking facilities for shoes. Synthetic floor surfaces are now available which will permit walking on ice skates from the ice to the change areas, the concessions, or into the warming rooms. Adjoining the warming room in many rinks is a food concession. A first-aid room for the handling of skating falls and injuries should be provided. A skate-rental facility is another feature found in many artificial-ice rinks. A lockable storage area for equipment and supplies should be provided.

OTHER USES FOR ARTIFICIAL-ICE RINKS

If the rink has a concrete or asphalt surface and is not used for skating 12 months of the year, uses should be considered for the off-season. With only slight modifications, the skating area can be used for tennis, badminton, volleyball, and other such activities requiring smooth playing surfaces.

NATURAL-ICE RINKS

PRESEASON PREPARATIONS

When the rink is to be laid on the ground, sufficient moisture must be in the soil or applied to it to develop a firm soil crust. The area should be watered if a dry condition prevails. If a temporary dike is needed, it should be made in the fall so that settling can take place.

If the rink is to be made on a concrete surface such as a tennis court, all drains should be sealed. The available water supply should be checked, and all equipment needed for filling the area, spraying, scraping ice, and removing snow should be ready and on the site prior to rink-building time.

RINK CONSTRUCTION PROCEDURES

Site characteristics control in part the procedures necessary to build natural-ice rinks. If the ground is level and

water can be contained by means of grade or dike, flooding is possible. If these conditions do not prevail, it is necessary to spray the water into the rink. Flooding is faster and more economical, while spraying provides ice when flooding fails. Either process calls for temperatures of 20°F or colder, and the colder the temperature, the faster the rink ice can be made.

In either the spraying or flooding method of ice-building, the temperature of the water must be taken into account. Water coming from the main contains sufficient heat to melt ground frost. Therefore, it is advisable to flood at a slow-enough rate to permit water to chill before the frost melting point is reached. If spraying is necessary, the hose should be fitted with a spray nozzle and the water should be directed high in the air. Since lower temperatures occur in the evening, many communities do their flooding or spraying at night, thus obtaining a faster build-up of ice. The periods of delay, when it is necessary to wait for the sprayed coat of water to freeze, are shorter at night.

The rate of build-up in a spray operation may be accelerated by diking the base ice with snow to reduce runoff. Care should be taken not to melt into the snowbank with too much water at one time. Shell ice will result.

Shell ice occurs when water seeps away after the surface is frozen over. Seepage can occur if the ground frost melts, a leak in the dike develops, or water melts away a part of the snowbank. Shell ice will remain a problem until it is removed. If air pockets develop in the process of flooding, they should be punctured and filled with water before flooding is completed.

Natural-ice skating rinks can be created on tennis courts or other hard-surface areas, although costly additional construction is necessary. Some types of tennis courts do not hold up well if water is frozen on their surfaces.

LINER-TYPE RINKS

In many areas of the country, the traditional method of building natural-ice rinks is almost impossible because of constant freezing and thawing. In order to have success with the usual natural rink, temperatures must remain near or below freezing. Fluctuating temperatures cause the ice to melt and the ground to thaw. Where this occurs frequently during the season, the natural-ice rink construction is impractical. In order to provide a skating facility under these circumstances, the liner-type rink is a possibility.

In the liner-type rink, a plastic-type liner (polyethylene) is used to prevent water seepage and to waterproof the floor and sides of the rink. This material is available in large sections—100' x 100', 200' x 200', and variations of these sizes. A framework to contain the liner should be constructed on flat ground, or around the edge of a hard-surface area. Sand is placed on the inside for a distance of 10 to 12 inches from the bottoms of the boards and shaped to form a cove. The liner is placed on the inside of the framework and up over the top. A cap of 1" x 4", which will extend below the ice on the inside, is necessary around the structure in order to prevent skates from puncturing the liner. The rink is then filled to the proper level with water.

Fencing and a ramp and rail are recommended. A plan for the inclusion of music may be desirable.

RESURFACING

The ice should be resurfaced when needed. This can be accomplished by scraping away or sweeping the cuttings and spraying a light coat of water over the ice. If some cuttings are left after scraping, a little additional water should melt them and a good skating surface will result.

ICE-SKATING FACILITIES

SAFETY CONSIDERATIONS

The thickness of ice is critical on ponds, streams, and lakes used for ice skating, and proper safety precautions

should be taken to prevent accidents. Ice should be four inches or more in thickness to be certified as safe. Warning signs, barriers, and the dissemination of warnings through public-communications media are desirable.

SELECTED REFERENCES

Gabrielsen, M. A., and Miles, C. M., *Sports and Recreation Facilities for School and Community*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1958.

Scott, Harry A., and Westkaemper, Richard B., *From Program to Facilities in Physical Education*. New York: Harper and Brothers, 1958.

Rink Covers and Enclosures. Proceedings, Fifth Annual Conference. Fort Myers, Fla.: Ice Skating Institute of America, P.O. Box 955, 1964.

Chapter 17

FIELD HOUSES

The term "field house" was applied originally to a facility for the storage of equipment, or to an enclosed area with a dirt surface to provide for practice of such intercollegiate sports as football, baseball, track, and tennis where climatic conditions did not permit early-season practice out-of-doors. Field houses were also used for practice of intercollegiate sports and for outdoor physical education classes during inclement weather. The modern field house is used for conducting outdoor physical education and recreation activities under cover, but, at the same time, it may provide facilities for a variety of other activities.

For detailed information on general building features, see Chapter 4.

PLANNING

It cannot be overemphasized that an adequately-planned and well-constructed building is a key factor in enabling the physical education program to provide adequate service to the college or university of which it is a part. A survey of available campus facilities for conducting activities common to modern physical education programs will determine the number and kind of activity units to include in the building.

DESIGN

Items that should be considered in designing a field house are: accessibility, beauty, economy, flexibility, supervision, and utility.

The following list of recommendations concerning design and construction may serve as a check list for schools contemplating the building of a field house (not listed in priority order):

- Provide ample space for the activities desired.
- Include adequate administrative, recreational, and service facilities.
- Design for future needs.
- Provide accommodations for men and women.
- Provide drainage around the exterior of the building.
- Provide adequate storage space.
- Install proper lighting.
- Provide for maintenance of light fixtures.
- Provide adequate wiring, with provision for high-voltage current.
- Provide windows and skylights with minimum glare intensity.
- Install sufficient and well-placed heating vents.
- Provide for sufficient natural ventilation.
- Include adequate exhaust fans and vents.
- Provide waterproof insulation for the ceiling.
- Place pipelines an adequate distance from the floor.
- Include sufficient rest-room space.
- Provide sufficient shower and locker facilities.
- Install an adequate public-address system.
- Include adequate facilities for cleaning and maintenance.
- Include sufficient water outlets.

LOCATION

Considerations related to the location of the field house are as follows:

- The field house should be accessible to those who use it most frequently. Therefore, it should be located near the major classroom buildings, dormitories, and physical education buildings.
- The field house should be located in attractive surroundings and should be pleasing in design. The design should be functional rather than traditional. It is possible for an architect to plan a building whose design will be modern and functional, but still blend in with the other architecture of the area.
- Facilities should be so located as to permit expansion. Attention should also be given to the slope of the land outside the buildings to prevent surface drainage.
- Consideration should be given in some institutions to joining the field house and other physical education facilities. Such a decision may eliminate the need to duplicate in the field house the office suite, central equipment supply room, dressing-locker rooms, shower rooms, training room, and other service facilities.
- Athletic fields and playing courts should be contiguous to the field house.

SIZE

The size of the field house and the type of facilities to be provided will be dictated by: the present and anticipated future programs of physical education, recreation, and athletics; the climatic conditions of the area; facilities already in existence; and the amount of money available. No matter what the size, however, the building should be planned not only to satisfy present needs but also those of the foreseeable future.

Some institutions may wish to plan a field house in connection with a stadium. In this case, consideration should be given to combining the two structures in such a manner that the back wall of the stadium may serve as one of the sidewalls of the field house. Such a plan may have interesting possibilities, both from the standpoint of economy and with respect to a more effective development of the areas under the stadium.

The minimum length of the field house should accommodate at least a 60-meter straightaway for men's track, plus sufficient distance for starting and stopping. A wide door at the end of the straightaway, to permit competitors to run outside the field house, will prevent injuries and eliminate a mental hazard where space is limited. Six lanes are desirable. Some provision should be made for the elimination of entrances so as to protect individuals who may enter the field house at track level and collide with runners on the track. The track should be of such a size as to be a convenient fraction of a larger standard distance.

Even though field houses of many shapes and sizes have been erected, present and future programs should be carefully delineated by program specialists before the size and

FIELD HOUSES

shape of the structure are determined. The minimum width required to house a baseball infield is 125 feet. A one-eighth mile track enclosing baseball facilities requires an area at least 200 meters long and 160 feet wide.

LAYOUT

The layout of the field house will determine the extent to which it will serve the purpose for which it was intended. Space will most likely be provided for track and field sports, baseball and football, and, in some instances, for basketball and tennis. The total area required for a track depends upon its proportional length of one mile, the radius of the curves, and the actual width of the running distance. The width of the running track should be at least 18 feet, and, for hurdle races, the lanes should be a minimum of 3 feet in width. The track within a field house should be so located that it is usable during the indoor training season.

Special areas for the shot put, high-jump, long-jump, triple-jump, and pole-vault events should be provided within the track oval or adjacent to the outer periphery of the

track. The shot-put area should be isolated at one end of the building. Permanent pits should be located near the sides of the building. Temporary units can be excavated within the track oval for meets attracting numerous spectators, or movable pit boxes can be used. For high jumping and pole vaulting, portable pits may be used.

ENTRANCES

A paved access roadway should serve the field house, and provision should be made for trucks to enter the building and move to unloading points without damage to floors. Entrances to the field house should be so located as to reduce to a minimum the possibility of injury caused by persons or vehicles entering or leaving the building.

DRINKING FOUNTAINS

The activity areas will require installation of recessed-type refrigerated-water drinking fountains. Flush-type cuspidors, located no less than three feet from the fountains, should also be provided.

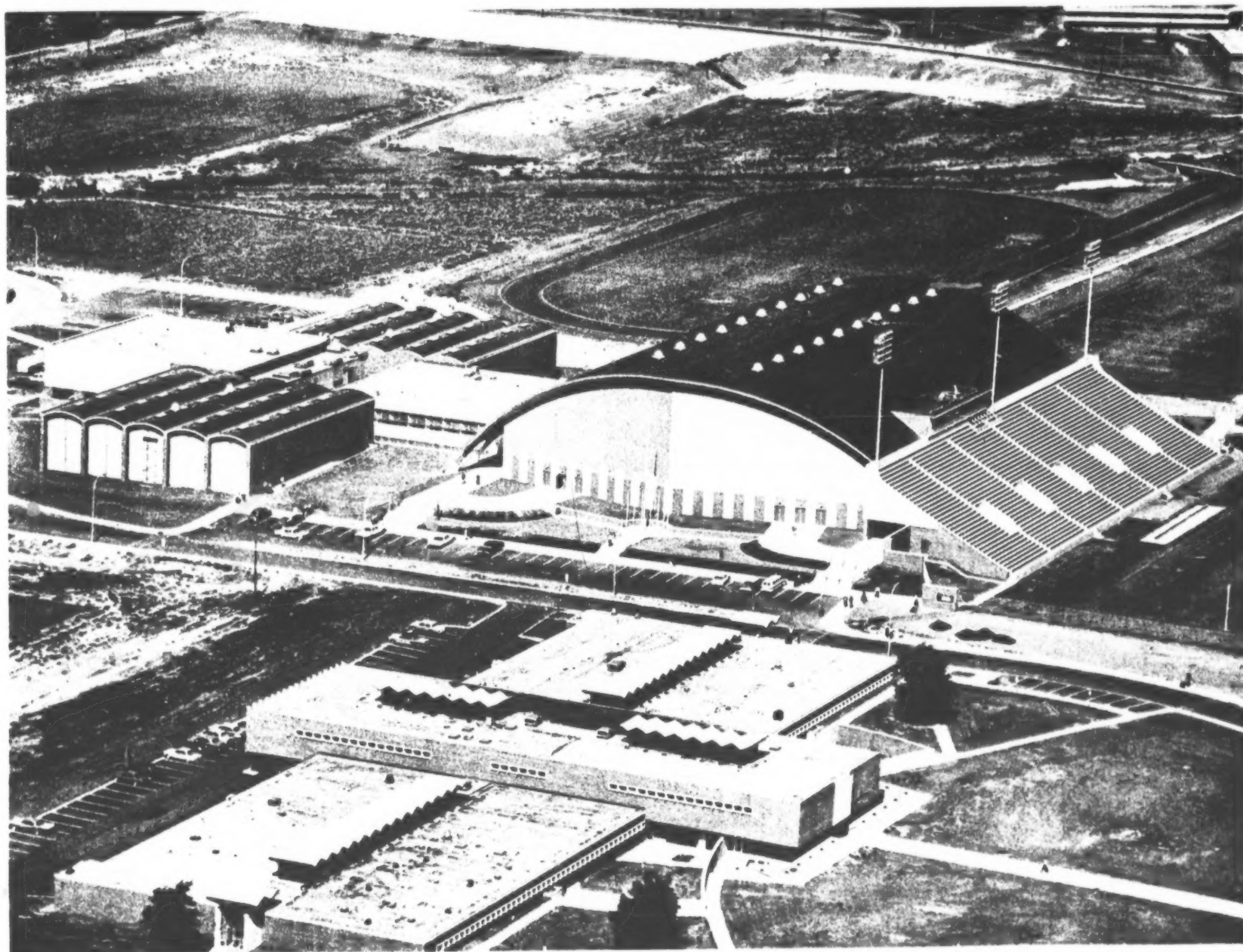


Figure 49
Physical Education and Athletic Complex, Illinois State University

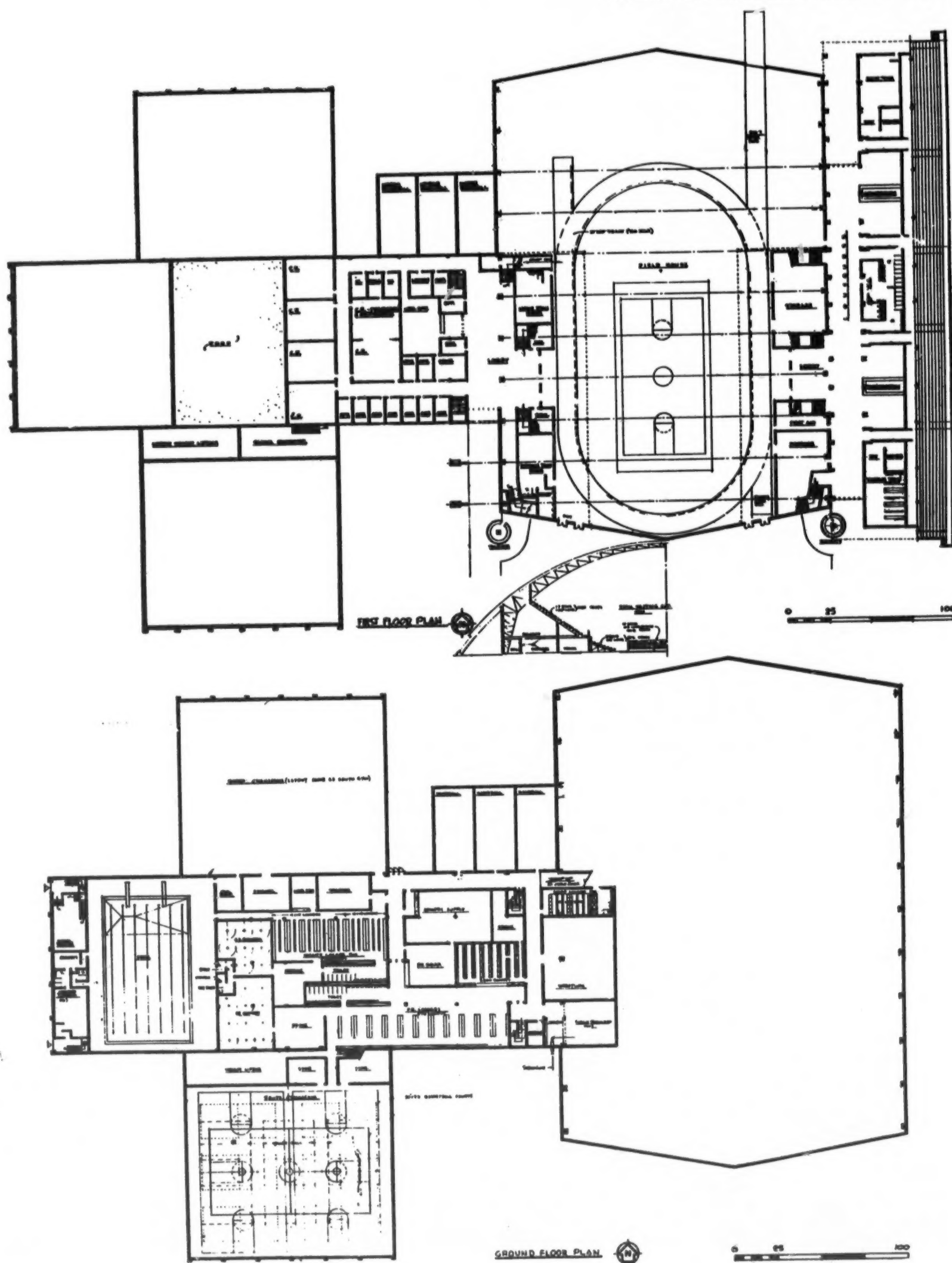


Figure 50
Floor Plan of Physical Education and Athletic Complex, Illinois State University

FIELD HOUSES

SERVICE AREAS

An underpass from the existing physical education building to the field house may be desirable in order to make service areas in the existing building available to some participants in the field house. If the field house is not adjacent to any other facility, consideration should be given to the erection of a field service building, simple in design, with storage space and dressing, shower, and toilet facilities. Specific information on locker, shower, toilet, and other service facilities may be found in Chapter 9.

TRAINING AND FIRST-AID ROOMS

Training-room facilities and personnel should be available to all students requiring their services and should be easily accessible to participants in the field house. Detailed recommendations concerning training and first-aid rooms may be found in Chapter 9.

STORAGE SPACE

Many field houses have been constructed with insufficient storage space. Space should be provided for equipment and supplies for both the physical education and athletic programs. Supply rooms should be large enough so that both supplies and equipment can be cared for and issued from them. It is essential to have adequate and conveniently-placed storage space if the facilities are to be fully usable.

Every attempt should be made to avoid using odd-shaped areas or space left over in a corner.

After a building is completed, it is impossible to add storage space unless that space is taken from areas which were designed for other uses. Thoughtful planning of storage space should be done when one is setting forth his total space needs. Adequate maintenance and control over supplies and equipment is possible only when proper storage space is available.

Another consideration of major importance in connection with storage is the provision of adequate-sized entrances to storage areas. An adequate loading dock may also be required, depending upon the types of supplies and equipment to be used. Additional information on storage areas may be found in Chapter 9.

PUBLIC-ADDRESS SYSTEM

Provisions should be made for the installation of a public-address system. Acoustical treatment of the building is desirable. Specific details may be found in Chapter 4.

FLOORS

Every consideration should be given to the latest developments in types of floor surfacing. The basic functions to be served by the field house in the particular institution will determine the final selection. See Chapter 4 for detailed information on floors.

SELECTED REFERENCES

Scott, Harry A., *Competitive Sports in Schools and Colleges*. New York: Harper and Brothers, 1951.

Scott, Harry A., and Westkaemper, Richard B., *From Program to Facilities in Physical Education*. New York: Harper and Brothers, 1958.

Snowberger, C., "A Functional Fieldhouse," *Journal of Health, Physical Education, and Recreation*, Vol. 35, No. 1, January 1965, pp. 38-41, 52.

Chapter 18

ARENAS

An arena is a structure to provide mass seating for spectators around an activity area. The activity area may serve only one purpose or it may be constructed to serve several purposes, readily interchanged, or with planned adaptations. Depending upon the purposes and the climate, the arena may be connected to the field house. When these two facilities adjoin the gymnasium, the total complex provides for the instructional, professional education, intramural, recreational, co-recreational, and athletic programs. The arena itself can be used not only for spectators at competitive activities, but also for such events as demonstrations, exhibitions, commencement exercises, concerts, tournaments, and mass meetings.

For detailed information on general building features, see Chapter 4.

PLANNING

The same basic principles apply in the planning and construction of arenas as for other athletic, physical education, and recreation facilities. An adequately-planned and well-constructed building will enhance not only the athletic program, but the program of the entire college or university. A survey of modern athletic programs and a careful analysis of the needs of the particular institution determine the nature and type of building to be constructed.

DESIGN

The following guides in design and construction might serve as a check list for colleges and universities contemplating an arena:

- Provide ample space for the activities desired.
- Design for future needs.
- Provide for expansion or change.
- Provide for portable facilities.
- Plan for accommodation of spectators in areas where needed.
- Provide well-designed spectator exits.
- Provide drainage around the exterior of the building.
- Include an adequate lobby and vestibule.
- Provide for adequate storage space.
- Install proper lighting.
- Provide for maintenance of light fixtures.
- Provide a sufficient number of electrical outlets, and place them for easy access.
- Provide adequate wiring, with provision for high-voltage current.
- Select good paint colors for the interior of the building.
- Provide windows and skylights with minimum glare intensity.
- Place windows away from goals and goal lines.
- Install sufficient and well-placed heating vents.
- Provide for sufficient natural ventilation.
- Provide filters in the air-circulation system.
- Include adequate exhaust fans and outlets.
- Provide waterproof insulation for the ceiling.

- Place pipelines an adequate distance from the floor.
- Include sufficient rest-room space for men and women.
- Provide sufficient shower and locker facilities.
- Provide well-placed ticket-sale and ticket-taking facilities.
- Provide for telephone, television, radio, and telegraph facilities in the press area.
- Provide an adequate sound system.
- Include adequate facilities for cleaning and maintenance.
- Include sufficient water outlets.
- Provide a large enough entrance for the delivery of equipment to the arena.

LOCATION

Institutions planning an arena should consider the following items related to the location:

- An effort should be made to locate the structure away from industrial and congested areas.
- Arenas should be so arranged that effective supervision is possible with a minimum of effort and cost. Offices should be located as conveniently as possible to all facilities. Equipment and supply rooms should be located within or adjacent to the dressing rooms so that supervision of the locker room is possible from the supply-issue rooms.
- The arena should serve as a functional facility.
- The arena should be so constructed that exclusion of unauthorized persons from certain designated areas is possible.
- The facilities of the arena which are open to spectators should be easily accessible to the public with a minimum of traveling through other areas. An analysis of the anticipated traffic flow in the building will pay enormous dividends in terms of easier supervision and lower maintenance costs.
- Facilities should be planned and located using a long-range approach which will permit possible expansion.
- Engineering features for foundations, reinforcement, drainage, pumps, and valves should be determined in the light of the qualities of the land area.
- Adequate parking areas adjacent to the facility, with a paved access roadway leading to the building, are necessary. Institutions having stadiums may wish to take advantage of stadium parking facilities to accommodate persons using the arena.

SIZE

The needs of the particular college or university will determine the arena size. The height of the structure will be determined by the number and location of balconies to be provided. The arena must be able to accommodate crowds effectively and safely. This will be particularly true when many different types of activities are scheduled.

The floor size should be dictated by the activities to be conducted in the building. It is recommended that the activity-area dimensions be not less than 150' x 250'.

BALCONIES AND BLEACHERS

When permanent balconies are planned, they should be constructed without supporting pillars which would interfere in any way with the playing or visual area. Balconies should be served by ramps which connect directly, or by means of wide corridors, with convenient entrances and exits. Temporary bleachers, when placed in front of and below the permanent balconies, should continue the sight lines of the balconies. Such bleachers should be inspected thoroughly before they are used, and their capacity should never be taxed.

In arenas designed primarily for basketball, spectators should enter and exit at a single level at various points around the circumference, from an exterior perimeter walk-

way. Designers may decide on the use of a continuous cross aisle connected through the exit tunnel to the concourse. In such a design, all seats above this cross aisle are accessible only by means of stairs in each exit tunnel, while the lower seats can be reached from the vertical aisles connecting the main cross aisle. This system simplifies the flow of spectators to and from an event, and allows for efficient management and control at one level. A portion of the lower seats are attached to telescopic platforms which roll back into wall pockets when a larger arena floor is desired.

The arena should be so designed that the normal flow of traffic will not encroach upon the activity areas. This is essential in order to avoid interference with activities and to decrease maintenance costs.

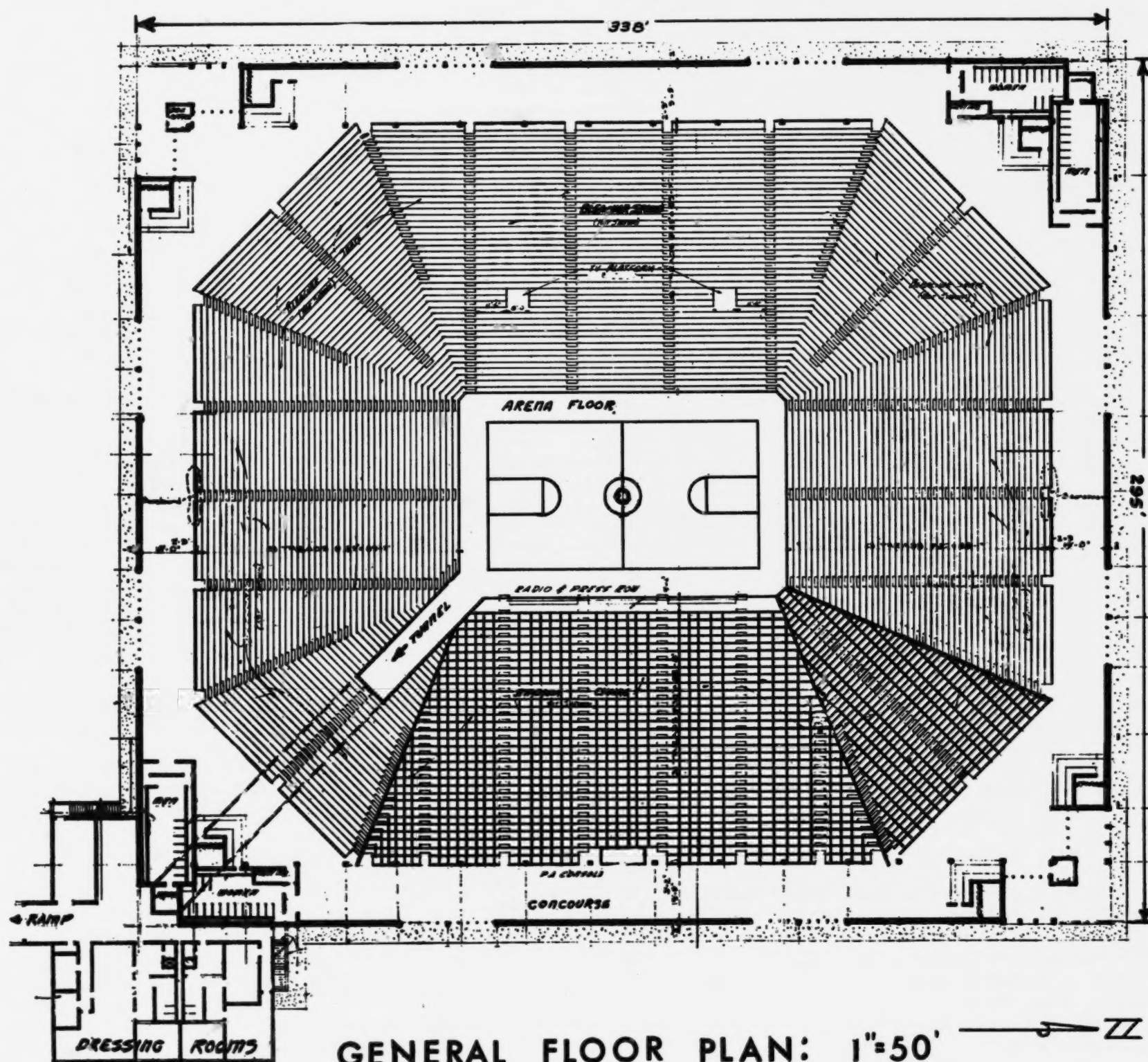


Figure 51
Arena, University of New Mexico

Balconies can be constructed as a continuation of bleachers or they can be elevated above them and partially extend over the seating at a lower level. Requirements for ramps, stairs, aisles, exits, doors, corridors, and fire-alarm systems may be obtained from local and state officials and the National Fire Protection Association.¹ Following an event, it should be possible to empty the building within a reasonably short period of time.

Bleachers can be of the roll-away, folding, or reverse-stack type. There is considerable expense connected with the latter type, and, consequently, it is not recommended except as supplemental seating.

The height of the last row of seats is determined by the number of rows and the increased elevation of each. The height of the seating surface of the first row should be 22 inches from the floor, and each successive row should be from 8-1/2 to 11-1/2 inches higher than the preceding one.

The width of each seating space should not be less than 18 inches, with 24 inches recommended. The space required per person will vary from 2.7 to 3 square feet. Sight lines should be considered in relation to the increase in elevation between successive rows. It is preferred that spectators have focal points of vision at the court boundary line nearest to the seats. Focal points more than 3 feet above these boundary lines are unsatisfactory.

When bleachers are extended, the first row should be at least 10 feet away from the court sidelines and end lines. The depth of closed bleachers varies from 3 feet for 10 rows, to 4-1/2 to 7-1/2 feet for 23 rows.

The elevated seating deck or platform can be used to supplement the number of seats provided at floor level. Removable bleachers for the deck should be the same as those used at floor level. By adopting this design, additional activity space is provided on the deck and in the area under it. The depth of the deck depends upon the number of bleacher rows.

Permanent seating facilities may be provided in a balcony or on the level of the playing floor. Since permanent seats restrict the use of a basketball pavilion, they should not be used at the playing-floor level in such a facility. Balconies may be constructed to provide seats to supplement removable bleachers at court level and on the elevated deck. Balconies can be constructed as a continuation of removable bleachers or can be elevated above them and be partially extended over the seating at a lower level. The balcony should be so designed that spectators in each row have the desired focal points. The seats for a balcony can have backs or can be similar to those for stadiums. To determine requirements for ramps, stairs, exits, doors, corridors, and fire-alarm systems, planners should consult local and state laws and the recommendations of the National Fire Protection Association.

COMMUNICATION FACILITIES

Accommodations for reporters, sports broadcasters, TV announcers, motion-picture cameramen, and scouts should be planned in the original design. It should be noted that the working press prefers to be as close as possible to the action at basketball games. Consequently, space for them during these contests should be provided at courtside. Soundproof broadcasting and television booths should be provided for radio and TV services when the arena will be used for attractions of considerable public interest. If com-

munication facilities are located high in the arena, an elevator should be provided. A rest room and refreshment facilities should also be included. Serious consideration should be given to television-installation requirements—both closed-circuit and conventional types. Detailed information on sound control and acoustics may be found in Chapter 4.

ENTRANCES

Entrances to the arena should be located with reference to parking facilities and traffic approaches. Provisions should be made for a paved access roadway into the arena, in addition to at least one entrance large enough to accommodate trucks. The main lobby should be of sufficient size to accommodate anticipated crowds seeking tickets and admission. This is particularly important in northern climates.

The lobby should be so designed for ticket selling and collecting that the traffic will flow in a straight line, or nearly so, from the entrances to the box office to the ticket collectors. To avoid congestion, approximately two-thirds of the lobby should be planned for accommodating box offices and ticket purchasers. The remainder should be reserved for ticket holders, who should have direct access to admission gates.

DRINKING FOUNTAINS

An adequate number of refrigerated-water drinking fountains should be provided. Recessed-type fountains are recommended. Flush-type cuspidors should be installed and should be located no less than three feet from the fountains. Drinking fountains should be so located that they do not interfere with the circulation of the crowd.

SERVICE AREAS

Conveniently-accessible dressing units, equipped with chalkboards and tackboards, should be provided for the home and visiting teams. When the arena is to be used for intercollegiate or interscholastic basketball tournaments or other competitive athletic events, consideration should be given to providing separate locker rooms with adjoining shower and toilet facilities. These units could be used at other times throughout the year by intramural and other activity participants. It is desirable to provide passageways from dressing rooms directly to the arena floor to avoid crowd interference.

A dressing room with adjoining shower and toilet facilities should be provided for staff members. It is desirable that a separate dressing room be provided for game officials.

Separate toilet facilities in sufficient number for men and women spectators should be provided in close proximity to the seating areas. Toilet rooms should be located near traffic lanes.

For detailed information on service areas, see Chapter 9.

STORAGE SPACE

Arenas require adequate storage space. Supply rooms should be of sufficient size to accommodate the storage, repair, and issue of athletic equipment. These areas should be strategically located in the building and properly secured and ventilated. Proper control of supplies and equipment can only be accomplished when proper storage space is provided. The equipment room should be so constructed as to facilitate efficient checking in and out of equipment. It is also important that adequately-sized entrances to the storage areas be provided. To facilitate the handling of large and

¹ Building Exits Code, National Fire Protection Association, 60 Battery March Street, Boston, Mass.

ARENAS

heavy equipment, a loading dock should be constructed. An elevator is necessary for the movement of equipment to different levels.

CONCESSION BOOTHS

When the arena is planned to accommodate large crowds, concession booths should be constructed. They should be equipped with electric stoves, sinks, hot and cold running water, and sewer connections, and should be located where they do not interfere with the normal flow of traffic.

LOUNGE AND TROPHY ROOM

If space and funds are available, a combination lounge and trophy room is advisable for a variety of uses connected with the athletic program. An adjoining kitchenette is also desirable. Some institutions may wish to display trophies in areas more accessible and convenient to public view.

SCOREBOARDS AND TIMING DEVICES

Scoreboards and timing devices should be of sufficient number and be so placed that they can be seen readily by players and all spectators. They should be easy to operate and readily accessible for maintenance purposes.

PUBLIC-ADDRESS SYSTEM

Provisions should be made for the installation of a public-address system. Specifications for such systems may be found in Chapter 4.

Acoustical treatment of the building is desirable.

FLOORS

Careful consideration should be given to the latest developments in types of floor surfacing. The basic use of the facility should be the determining factor in the final selection of the type of flooring.

SELECTED REFERENCES

Howard, G. W., and Masonbrink, E., *Administration of Physical Education*. New York: Harper and Row Publishers, 1963.

Scott, Harry A., *Competitive Sports in Schools and Colleges*. New York: Harper and Brothers, 1951.

Scott, Harry A., and Westkaemper, Richard B., *From Program to Facilities in Physical Education*. New York: Harper and Brothers, 1958.

"Survey of All-Weather Playing Surfaces," *Scholastic Coach*, Vol. 36, No. 5, January 1967, pp. 15-16, 62-63.

Chapter 19

STADIUMS

The stadium is a permanent seating structure around a sports field for viewing sports events and other activities. The same general rules of planning relate to stadium construction as to the other parts of the physical education and athletic plant. The program dictates the structure.

The size and design of the stadium will be influenced by such factors as the following:

- The particular functions it is to serve in the total program of the college or university and community
- The number of persons it is to serve presently and in the foreseeable future
- The topography of the land and the climatic conditions of the region
- A conformity to the official rules of the sports which it is to serve.

Those responsible for planning stadiums should keep in mind that the structure is a service unit to the physical education, recreation, and athletic programs of the institution. In the early stages of planning, there should be a joint effort of all concerned. The professional staffs of the departments involved should furnish the curriculum and activity requirements. All uses should be investigated as they relate to the total educational program. From the standpoint of justification, a multiplicity of uses might be the determining factor for approval.

For detailed information on general features of outdoor facilities, see Chapter 5.

DESIGN AND SHAPE

After those persons responsible for planning have determined the uses and the desired seating capacity of a proposed structure, a selection is made of the design which best serves the intended purposes. State and local building codes and other standards furnished by professional organizations and trade associations can be used as guides in planning.

The architectural design of the stadium must consider aesthetic values. It is desirable to design a structure for beauty as well as for utility. Ideally, the structure should harmonize with the character of the terrain and conform to the architectural style of the region, the community, or the other buildings of the campus where it is located.

Outdoor structures for spectators are found in a variety of shapes (see Figure 52). The most common of these shapes are as follows:

- Crescent
- Rectangle
- Muleshoe
- Horseshoe
- Bowl

The crescent design places the greatest number of seats opposite the center of action. This shape is usually of permanent construction and used for sports requiring a rectangular playing field. The front is parallel with the field, but the back and sides form a continuous curve with its center located on the midline of the field. In this design, the

preferred seats are higher up, opposite the center of the field. Another design based on the crescent principle is composed of rectangular seating sections, the depth of which decreases as the units extend toward the goals. This design is economical because curved backs and sides are eliminated. Another advantage is that the greatest number of seats are concentrated within the 40-yard lines.

The rectangle is the most common and least complicated structure. It provides for practical and economical expansion when necessary.

The muleshoe and horseshoe are two designs intended for permanent structures with large initial capacities. Except for bowed tiers in the horseshoe type, they are similar. Better sight lines in the bowed tiers provide the advantage of facing the spectators toward the center of action. This advantage, however, is reduced by the fact that curved construction is more expensive than straight-line forms. The muleshoe stadium (see Figure 52) allows for inclusion of a 200-meter straightaway for a track, plus additional space for field events. There is some merit in building a muleshoe stadium in stages, with the initial structure being rectangular.

The bowl-design stadium, built to handle large crowds, has both advantages and disadvantages over those already discussed. It completely encloses the playing field, which rules out a 200-meter straightaway unless special provisions are made. Consideration may be given to adding a second deck as additional seats are required.

FOOTBALL AREA

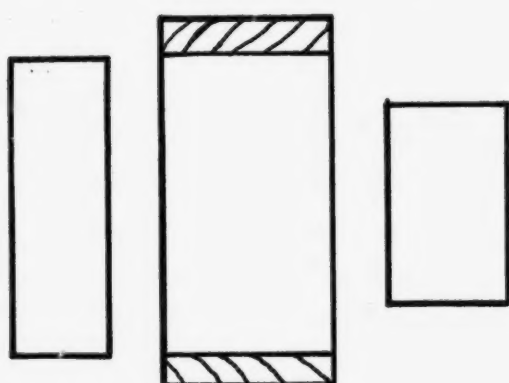
The development of any stadium football field should include an overall grading-and-drainage plan prepared by a competent professional. Provisions should also be made for an adequate watering-and-sprinkling system. The field should be crowned at the center, sloping up to one-fourth inch per foot toward the sidelines. The total area for football should be not less than 85,000 square feet. The field should be on a north-south axis.

TRACK-AND-FIELD AREA

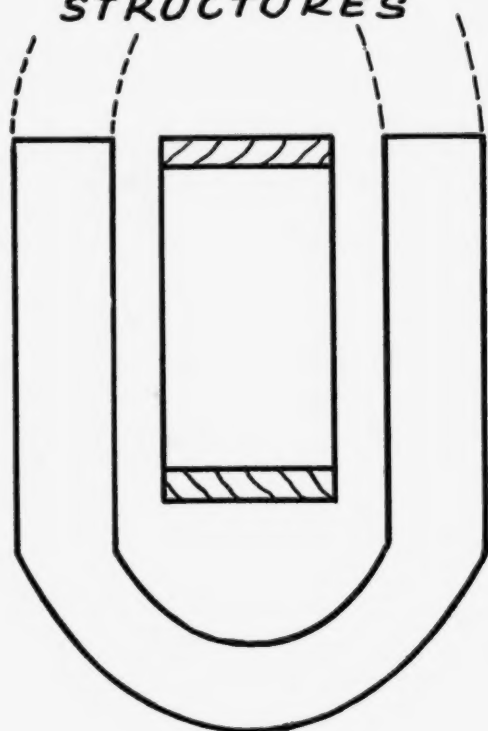
Track-and-field spectator seating is generally parallel to the straightaway for the dashes. Some planners, however, have located spectator seating so that the structure angles in gradually toward the straightaway end of the track. The front end of the structure nearest the starting line should be farther away from the track than the front end nearest the finish. This arrangement faces the spectators toward the most common center of continuing action. This type of arrangement can be planned and designed without interfering with other activities when the track-and-field area is a facility by itself.

Track-and-field activities require several acres of ground to include space for the development of a quarter-mile oval, running track with a minimum straightaway of 175 to 180 meters. The straightaway should face north so that partici-

SHAPES OF OUTDOOR SPECTATOR STRUCTURES

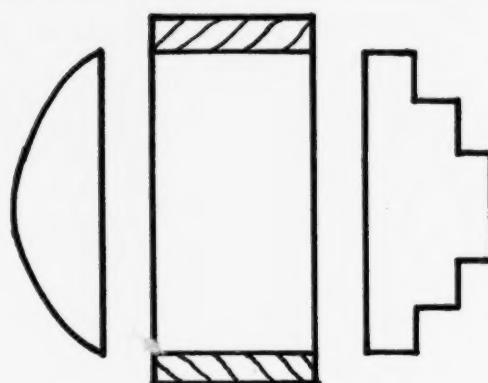


RECTANGULAR
STRUCTURES

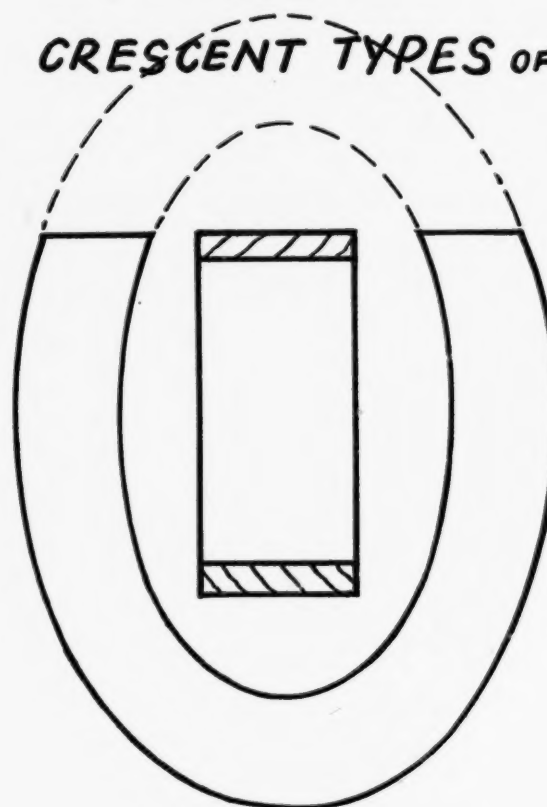


MULESHOE STADIUM

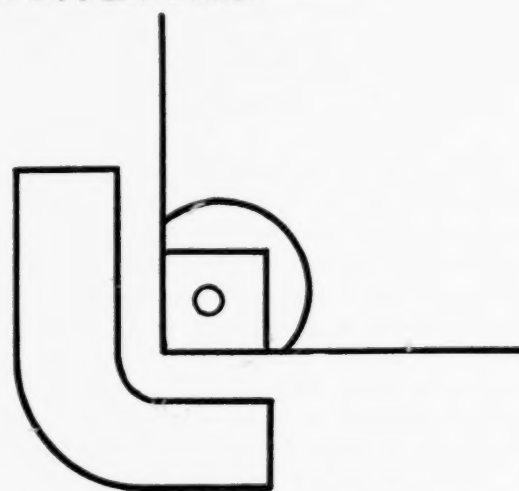
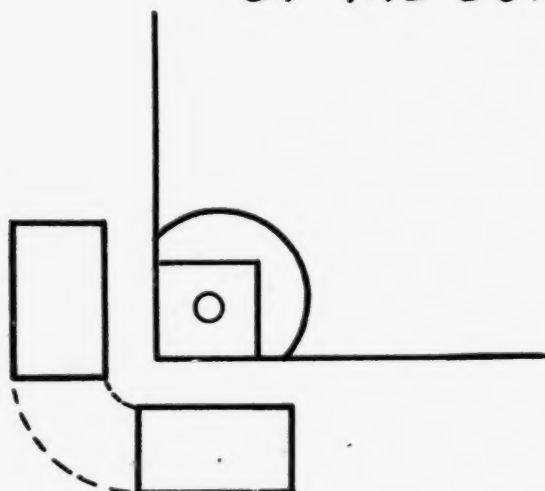
(THE BOWL SHAPE ENCLOSSES BOTH ENDS AS INDICATED)
BY THE DOTTED EXTENSIONS



CRESCENT TYPES OF STRUCTURES



HORSESHOE STADIUM



THE "V" AND MODIFIED "L" STRUCTURES

Figure 52
Shapes of Outdoor Spectator Structures

pants in hurdles and sprints do not run toward the north.

The track should be flat, and the surface should be composed of cinders or synthetic material. Track rules require that there be a two-inch solid curb constructed around the interior of the track. This curb may be made of wood, concrete, asphalt, or steel. Inclination of the track should be limited to the ratio of 1 to 100 laterally and 1 to 1,000 in the running direction (for field events, in the jumping or throwing direction). Most tracks are constructed so that lateral inclination is toward the inside curb, where small scuppers permit the water to drain from the track to the edge of the infield.

Field events which should be considered in planning track-and-field areas and facilities are: road walk and steeplechase; high, long, and triple jump; discus and shot-put; javelin; and pole vault. A raised landing platform covered with huge chunks of rubber or with some other type of "portable pit" is generally placed over the pole-vault landing pit so that the participant does not have so far to fall when landing. For the high-jump pit, the same type of landing platform may be used, provided the platform is placed closer to the high-jump standards.

For field events in which the participant must land in a pit, the landing area must be filled with sawdust or other soft material. The landing pit for the long and triple jump must have a minimum width of 9 feet and a minimum length of 15 feet. The scratch line for the long jump is approximately 12 feet from the near edge of the landing pit. For the triple jump, the scratch line should be placed at least 36 feet from the near edge of the landing pit. The high-jump and pole-vault landing pit(s) must be not less than 10 feet wide and 12 feet long. It is recommended that runways for the pole vault and jumping events be constructed of rubber asphalt or a synthetic material. The same type of material is recommended for the high-jump approach area and the throwing areas for the weight events.

BASEBALL AREA

The baseball stadium should parallel the home-to-first and home-to-third base lines. It may be constructed of wood, steel, brick, or concrete. To provide the most satisfactory vision for the most players, the layout of the diamond should be such that a line between home plate and second base intersects the path of the sun at right angles. If home plate faces south, the late-afternoon sun will be behind the first baseman. The stadium design resembles an "L" or a modified "V," and if permanent seating of the type mentioned above is not a part of the facility, demountable or mobile units may be arranged in the above-mentioned design.

The baseball field requires approximately three acres. If an outfield fence is used, it is generally placed 325 to 340 feet from home plate (measured down each foul line). The fence in straightaway center field is usually 385 to 410 feet from home plate. The diamond is 90 feet square.

It is important that there be a large frame backstop with sturdy wire netting, stationed 60 feet behind home plate. This backstop should be 20 to 25 feet high to keep the ball in the field of play. Attached to each end of the backstop should be a fence at least four feet high, 60 feet from the nearest foul line, and extending to the outfield fence where it joins it on foul ground 60 feet from the foul line. Where it is necessary to put the backstop a great deal less than 60 feet behind home plate, a hood which slopes 45° toward the field should be installed.

Turf is the ideal surface for the unskinned areas. These areas should be a mixture of natural earth, sand, and clay

or loam. The pitcher's mound should be largely of clay and is, by rule, required to be 15 inches above the baseline level. Fixed hollow posts should be driven beneath the bases to secure them. A two-percent slope from the pitcher's plate to the outfield facilitates drainage. Surface drainage in the direction of the slope is considered indispensable to good playing conditions.

IMPORTANT FACTORS IN STADIUM DESIGN

The main considerations in planning spectator structures involve seating decks, deck supports, seats, and means of ingress and egress.

SEATING DECKS AND DECK SUPPORTS

Several factors should govern the selection of materials to be used for seating decks and deck supports. These factors include expected capacity, intended use of the structure, availability of funds, climatic conditions, and desired aesthetic qualities. Wood, stone, brick, steel, and reinforced concrete are the materials most frequently used. The inclusion of service and other facilities under the stadium make mandatory a solid, continuous, and waterproof deck of either concrete or metal. Appearance, tensile strength, adaptability, exhaustibility, durability, and cost of construction and maintenance are items that should guide the buyer in the selection of building materials.

Concrete, structural steel, wooden columns, and natural or artificial embankments serve as supports for decks of spectator structures. Reinforced concrete columns are generally used to support concrete decks. Steel decks are usually surmounted on steel columns and beams. Either steel or wooden substructures support most wooden decks. The supporting structure of the stadium should rest upon foundations of concrete. The design of deck supports should meet structural strength requirements of state and local building codes, and the supports should be so located that they provide unobstructed spaces of the appropriate dimensions to accommodate proposed uses of the underneath portion of the stadium.

Stress standards should be considered at all times in stadium construction. Irrespective of the materials used for construction, all spectator structures should be designed to meet the following specifications: to support, in addition to their own weight, a uniform, distributed line load of not less than 100 pounds per square foot of gross horizontal projection; to resist a horizontal wind load of 30 pounds per square foot of all vertical projections; and to withstand a seat load of 24 pounds per linear foot of seats, and a force of ten pounds per linear foot applied in a direction perpendicular to the seats' length. Seating standards require that all seats and footboards carry line loads of not less than 120 pounds per linear foot.

Seating decks may be constructed of concrete, steel, or wood. Reinforced concrete is satisfactory, provided it is properly designed and constructed. One of the disadvantages of this type of material is its tendency to crack when it is used in structures located in areas north of the frost line. The proper placement of expansion joints, the sloping of treads to the front, and the adherence to standards for materials used in the concrete are guide lines to reduce the deterioration and maintenance cost for this type of material.

Bent steel plates may be used in the construction of steel decks (prefabricated sections of treads and risers). This type of deck affords flexibility in expansion. A facility of this kind may be salvaged and moved to a new site, and it is a sturdy, durable, and watertight (if welded) structure. However, steel plates do tend to deteriorate if not painted on a regular basis.

STADIUMS

A structure with a seating capacity of less than 5,000 persons might be constructed of wooden treads and risers mounted on concrete, steel, or wooden substructures. The only advantages of this type of construction are lower cost and portability of the seating facilities. Deterioration of the wood and the almost constant maintenance problems are disadvantages.

TREADS AND RISERS

The seating deck of a spectator structure has a stepwise-type surface of treads and risers. The treads form the horizontal surface while vertical surfaces form the risers. To minimize expense, treads and risers should be as small as possible but sufficient in size for comfort and good view. The height of the first riser should be kept to a minimum because it affects the ultimate height of the entire structure, and, therefore, the cost. The width of the treads is governed by factors of economy and comfort. A minimum depth of 24 inches is recommended for treads with backless seats. For structures without continuous seating decks, this measurement should be taken between the front edges of the seating surfaces of successive tiers. The minimum depth for treads supporting seats with backs is 30 inches. Tread widths remain constant except for the first tier, unless there is a railing, low wall, or fence in front, in which case, additional space is required for spectator movement.

Drainage must be considered in the design of treads for solid decks. A forward slope of 1/2 to 1 inch per tread will permit water to drain off rapidly, in addition to facilitating hosing the deck for cleaning purposes. Gutters and drains should be included for large structures. The standards for the size of the drain are based on the minimum ratio of 1 square inch to each 300 square feet of deck surface served.

State and local building codes set standards for aisles, entrances, and portals for spectator structures. Planners should be cognizant of such codes. Aisles may not be necessary in small seating structures. For structures with many rows and large capacities, however, aisles are necessary. Sections between aisles should contain tiers with 24 to 32 seats. The first aisles should be located 14 to 16 seats from the ends of the structure. Horizontal walks are generally undesirable because persons using them will obstruct the sight lines of others. If such walks are used, the next tread above should be high enough to permit the occupants to look over those persons walking in front of them.

Aisles should have a minimum width of 36 inches, and, if divided by a portal or obstruction, each side should be at least 24 inches wide. Whenever the riser height exceeds 9 inches, an intermediate step is necessary.

ENTRANCES AND EXITS

The seating capacity and the number of seats in each section will determine the number of entrances and exits required. It is important that spectators be dispersed in a minimum amount of time. It is highly desirable to have exit ramps leading from stepped aisles. Ramps, stairs, and passageways should be as wide as the deck aisles served. Stairs or ramps not opening directly into a street or open space should have lanes of at least 20 feet in width leading out of the area.

Entrances and exits for structures should be located for accessibility and be adequate in size and number for crowd dispersal. When entrances and exits are located at the front of a structure, a low fence or wall should separate the walkway from the playing-field area. The first tier of seats should be high enough to allow the occupants an unobstructed view.

DECK WALLS AND RAILINGS

The ends, backs, and, in some instances, the fronts of the seating structures should be bordered by walls or a railing. These walls or railings should extend at least 42 inches above the treads and be designed to prevent spectators from sitting on them.

SIGHT LINES

Seating facilities should be constructed to provide spectators with a good view of the performance. Nearness and an unobstructed sight line to the desired points affect the quality of the accommodations. A sight line is a straight line from the eyes of the seated spectator, over the heads of others below, and to a point on the field that represents the spot nearest the structure that should be in his field of vision (see Figure 53).

Recommended focal points for sight lines are as follows: for football, the nearest side boundary line; for track, about knee-height of the runner in the nearest lane; for baseball, several feet behind the catcher; for side seating for tennis, four feet in toward the seats from the doubles boundary line; and for end seating for tennis, ten feet behind the base line.

SEATING ARRANGEMENTS

Several factors enter into the design of seating facilities. These factors include the nature of the contest, the comfort and convenience of spectators, proper balance of cost and comfort, stadium cleaning, and maintenance expenses.

Back supports are generally unnecessary in stadiums because of the nature of the activity and the added cost of such supports. For planning purposes, an area of 2' x 2', or 4 square feet per seat, should be allowed for bench-type seats. The height of the seats above the foot-support treads should be between 16 and 18 inches.

Some designers make no allowances for seating other than directly on the treads. However, elevated bench-type seats are much more satisfactory.

Douglas fir, redwood, and southern cypress are the woods most commonly used for bench construction, since long experience has proved them to be satisfactory seating surfaces. Factors such as decay resistance, bleeding, strength, slivering, and cross section of grain warrant consideration in selecting the kind and quality of wood. Types of commercial covering which protect and aid in the maintenance of wood seats should be investigated. Synthetic materials—composed of plaster, Fiberglas, and the like—molded into seating structures are now past the experimental stage. Extruded aluminum, natural or in color, is fabricated into stadium-seat construction and may be found in many modern stadiums. The natural type is neither hot nor cold, withstands weather, defies insect destruction, and drains and dries quickly and cleanly.

SEATING CAPACITY

If possible, the seating capacity of a stadium should be sufficient to meet present needs, with plans for expansion to satisfy predicted needs for a period of at least 20 years. The number of seats required will be influenced by: the sports and other activities to be served; enrollment of the college or university; population and socioeconomic status of the surrounding city and region; available public and private means of transportation; and planned expansion of the program. The provision of an excessive number of seats should be avoided because construction and maintenance costs make it impractical to provide accommodations that are seldom used.

SIGHT LINES AND FOCAL POINTS

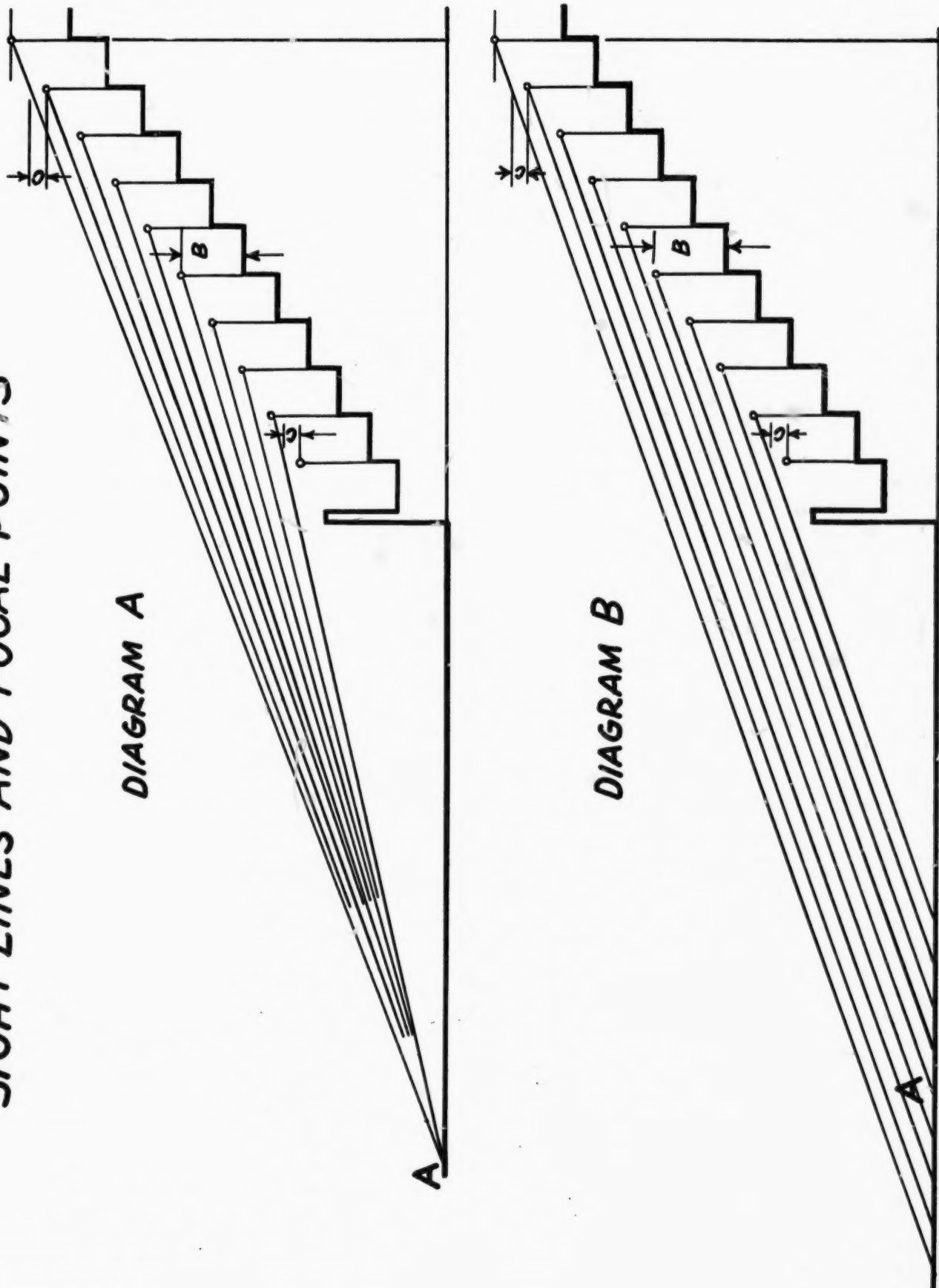


Diagram A shows a seating section with a gradual increase in riser heights. The focal points, "A", are the same from all seats. "B" represents height from a seat eye level. "C" represents the distance from eye level to the top of a spectator's head.
Diagram B shows a seating section with constant riser and tread heights. As the seating tiers progress upward, each focal point is closer to the field.

These diagrams are adapted from *Concrete Grandstands*, Portland Cement Association, Chicago, 1948.

Figure 53

SITE AND LOCATION

Since spectator structures should be easily accessible to the users, location is a prime factor in selecting the site. These facilities should be on the college or university campus and located near the gymnasium so that locker, shower, dressing, equipment, and other service facilities can be used. Duplication of existing adequate facilities increases the costs of construction, operation, maintenance, and supervision. There should be sufficient space to serve the activities to be conducted, and the building should be on a plot large enough for adequate safety provisions for traffic movement and parking requirements.

A primary requisite for a satisfactory site is adequacy of size. The topography of the land is also an important factor influencing the choice. The site should be flat or easily leveled. However, natural inclines of the topography can be used for support or partial support of a structure. Surface drainage of the site and adjacent areas, and the subsurface soils and geological formations should also be considered.

DEVELOPING THE SPACE UNDERNEATH THE STADIUM

The space underneath a stadium can serve a variety of purposes, but considerable planning for utilizing this space should occur at an early stage. Planners should not consider service units in this section of the stadium if no more than 15 rows of seats are contemplated. Under-stadium development is economically advisable only if the cost of construction of needed facilities is less than it would be at other available sites. Many colleges and universities may find it more feasible to develop the area underneath the stadium than to have the various functions which might be served there dispersed to more remote areas.

A variety of uses can be made of the space under a stadium. The most common facilities to be located in this area are: public toilet rooms, storage rooms, concession booths, and dressing rooms for competitors. Activity areas, classrooms, and offices might also be included in this area. One or more lounge rooms for pregame meetings and/or luncheons with the press, or for other similar purposes, may be provided if space is afforded. Other possible facilities to be developed in this space include: auditoriums and band rooms; dormitories and dining halls; instructional areas; maintenance shops; housing for the caretaker; basketball courts; auxiliary gymnasiums; practice facilities for baseball and track; and squash and handball courts.

Steps in planning the area under the stadium include: a determination of the capacity and type of the proposed structure; a study of other present and probable future facility needs; and a determination as to which of these needs can best be satisfied through development of the space under the stadium. Three important questions should be answered in determining the feasibility of developing this portion of the stadium. Is it possible to construct the facilities in keeping with the previously-determined requirements? Will these facilities permit the intended use? Is it economically practical? If the space under the stadium is to be developed, other important factors which should be considered are: the structure should be above the ground and/or permanent construction; the seating deck should be watertight; the space requirements of the various facilities will indicate the location and design of columns, trusses, beams, and other supports; the substructure should be designed to support the seating deck, and, at the same time, to provide a framework for the construction under the stadium.

Ramps, stairs, walks, and other stadium service facilities should be located to satisfy the intended purpose, but also

with consideration of facilities under the stadium. Common errors frequently made in the development of this area are the failure to provide a watertight seating deck—with the necessary inclusion of expansion joints—and insufficient fenestration and ventilation.

SERVICE FACILITIES

The nature and scope of service facilities depend upon the size of the spectator structure, the activities to be served, and the funds available for construction. Items to be considered in planning for service facilities are: provisions for cleaning the stadium; general lighting and electrical outlets; public toilets; protection against freezing; drinking fountains; public telephones; public-address systems; first-aid rooms; concession booths; radio, press, and television accommodations; ticket booths; storage rooms; gates and fences; and an access roadway. The availability of electricity, gas, water, and sewer connections affects the operation of several of the items listed above.

For detailed information on service facilities, see Chapter 9.

FACILITIES FOR CLEANING

Stadium cleaning can be expedited by providing the recommended deck slope, and drains with hose bibbs located not more than 100 feet apart. Paving the surface under the stadium seats, and installing drains and hose bibbs designed to prevent freezing, facilitates stadium cleaning.

LIGHTING AND ELECTRICAL FACILITIES

General lighting and electrical outlets should be planned to satisfy the requirements of the specific spectator structure. If night games are to be played, illumination is necessary for all areas to be used by spectators. The playing areas should receive extra illumination in situations where the last row of seats is several hundred feet away from action on the field. Uniform illumination is necessary for proper player judgment of the ball and its trajectory. Therefore, there should be uniform light throughout the playing area and the space around it.

Adequate light should always be provided in the stands. Some illumination should be provided on the ground immediately surrounding the playing field. Standards for the design of floodlights are published by the Illuminating Engineering Society (IES). Footcandle requirements may be found in Chapter 5.

The number and location of electrical outlets depend on the nature and scope of service facilities and other facilities under the stadium seats. Outlets are necessary for water coolers, scoreboards, concession stands, dressing and training rooms, ticket offices, first-aid stations, clocks, the press box, the public-address system, and telephones.

TOILET AND PLUMBING FACILITIES

Public toilet units should be located in an area that is easily reached from the seating area. Because the stadium structure is ordinarily not heated, all plumbing should be constructed so that it can be completely drained of water, and water lines should be buried beneath the frost line of the locality.

DRINKING FOUNTAINS

Care should be taken to avoid placing drinking fountains where the flow of pedestrian traffic would be impeded. However, they should be conveniently located throughout the stadium.

PUBLIC TELEPHONE FACILITIES

One public telephone should be provided for every 1,000 spectators, with a minimum of two for the stadium regardless of the seating capacity. Booths should be enclosed to eliminate noise, and should be placed in accessible locations.

PUBLIC-ADDRESS SYSTEMS

Public-address systems are a necessity in all stadiums, and large structures should have permanent sound systems operated from the press box. Additional outlets should be located in strategic spots on the field. The size of the structure will dictate the number and location of speakers. Provisions for increased volume does not solve the problem of lack of an adequate number of speakers.

FIRST-AID ROOMS

A first-aid room with approximately 150 square feet of space should be provided for every 10,000 seats. It should be located on the ground level and should be served by an access road—for ambulance service.

CONCESSION BOOTHS

There is a correlation between the volume of sales from concession booths and accessibility, which indicates that these booths should be accessible from all seats. Approximately 100 square feet per 1,000 spectators should be allowed for permanently-located concession booths.

COMMUNICATION FACILITIES

Press, radio, and television accommodations are necessary adjuncts to a modern stadium. The football press box should be located opposite the 50-yard line, preferably on the west side of the stadium. Baseball press boxes usually occupy some portion of the stand behind home plate, and tennis matches can best be served by a press box behind the end of the courts. Provisions must be made for television and radio, and a means of communication between the press box and the field is necessary.

Provision should be made for a press box in the original design of the stadium. The press box should be of sturdy, permanent construction and should be high enough to permit the occupants to see over the spectators standing in the preceding row. It should be heated and enclosed, with a glass front.

In cold climates, consideration should be given to providing an area for sports photographers at either end of the press box. A protected and heated structure providing overhead cover, with an open area in front from where pictures could be taken, might be constructed for a nominal sum.

Stairs and/or an elevator should provide access to the press box, and the latter is recommended if the press-box floor is over 30 feet above ground level. Public toilet facilities should be immediately adjacent, with a minimum of two water closets, or one for every ten occupants. Utility, telephone, and special radio requirements should be determined

by sound and electrical engineers and should be included in the original design.

TICKET BOOTHS

The number of ticket booths for a spectator structure depends upon the seating capacity, the number of preseason or pregame tickets sold, and the number of entrances. If the spectator structure is surrounded by a fence, booths can be located at the fence or in the area outside the entrance. All ticket booths should be well protected from the elements and constructed to prevent forced intrusion.

Every stadium should have a room within its enclosure where monies from concessions and ticket sales can be collected. The size of this office depends upon the capacity of the stadium and the scope of concession services.

Adequate heating, lighting, and ventilation should be provided.

STORAGE ROOMS

The nature, extent, and location of storage rooms vary in accordance with the proposed use of the stadium and its under portion. Storage rooms and entrances should be large enough to accommodate the equipment. Few stadiums have ever been constructed which have adequate storage space.

GATES AND FENCES

Where admission is charged, a fence with a minimum height of 7 feet surrounding the spectator structure and the enclosed field is essential. Gates are necessary for spectator and service entrances and exits. Admission gates should be located near the parking lots and other main approaches to the structure. The number and size of the entrances depends on predicted present and future attendance. Exits should permit the crowd to vacate the enclosure in 10 minutes or less. Twenty-two inches of linear exit space should be provided for each 500 spectators. At least one gate 14 feet high and 14 feet wide should be provided to accommodate trucks and buses.

ACCESS ROADS

A paved access roadway should serve the inner-stadium area. This road should lead directly to the concession booths, first-aid station, and dressing rooms if these are in the stadium.

SCOREBOARDS AND TIME CLOCKS

Scoreboards are essential for football and for baseball fields. Time clocks are also desirable for football.

PROVISIONS FOR FUTURE EXPANSION

If there is a possibility that the size of the stadium will need to be increased in the foreseeable future, the method of expansion should be determined and the necessary details incorporated in the original footings and other construction. Insofar as possible, the requirements for future expansion should be built into the initial structure.

SELECTED REFERENCES

Howard, G. W., and Masonbrink, E., *Administration of Physical Education*. New York: Harper and Row Publishers, 1963.

Hughes, W. L., and French, E., *The Administration of Physical Education*. New York: A. S. Barnes and Company, 1954.

STADIUMS

Scott, Harry A., *Competitive Sports in Schools and Colleges*, New York: Harper and Brothers, 1951.

Scott, Harry A., and Westkaemper, Richard B., *From Program to Facilities in Physical Education*. New York: Harper and Brothers, 1958.

"Sports Lighting," *Athletic Journal*, Vol. 42, No. 7, March 1962.

"Syracuse University Lighting Systems," *Athletic Journal*, Vol. 46, No. 3, November 1963.

Chapter 20

OFF-CAMPUS AREAS

Because of rapidly-increasing enrollments, many colleges and universities have been forced to procure areas and facilities beyond the boundaries of the campus to provide adequate instructional and recreational space for their growing campus families. The present chapter will discuss some of the types of off-campus areas now being developed.

PICNIC AND RECREATION AREAS

Ideally, the college or university will have picnic or cook-out areas within its main campus. These spaces should be within walking distance of other living and learning facilities. If this is not possible, they should be located where they will be accessible off-campus, and preferably in an area of wooded land which provides the picnic atmosphere. One or more three- to five-acre plots, properly landscaped with trees and shrubbery, will normally suffice for this activity. The availability of a stream or other body of water complements the setting, and a dependable supply of drinking water is necessary.

The picnic area should include tables and benches, simple shelters, and fireplaces equipped with grills for cooking. Toilet facilities, and provisions for disposing of bottles, cans, and other throw-away items are important.

A small "council ring" with benches clustered for group singing, and equipped for camp fires adds to the use of such areas. Consideration should be given to the provision of a small, smooth, concrete dance slab as a further means of enhancing the use and enjoyment by college or university groups.

Local park or recreation directors, state or national forestry services, and state highway personnel should be consulted for plans and specifications for the equipment items listed above.

RIFLE RANGE

Colleges and universities desirous of providing facilities for shooting marksmanship will need the technical assistance of the National Rifle Association (see Appendix K), which is organized and equipped to provide detailed written material and personal assistance. Because of the safety responsibility, and in order to develop shooting facilities which will be most efficient and effective, it is also recommended that assistance be obtained from the following sources: personnel of one or more of the service academies; state, local, and federal police organizations; the armed forces or National Guard; or members of well-organized rifle and shooting clubs. The section which follows is intended only for the purpose of providing general understanding as a first step in the process of developing shooting facilities.

SPACE REQUIREMENTS

The indoor small-bore rifle range requires a shooting distance of 50 feet. An additional 6 to 10 feet is needed for targets and bulletstops, and a minimum of 15 feet is needed

behind the firing line to accommodate shooters, instructors, and the service facilities they need. The distance between firing points is 5-1/2 feet or more, and while a minimum ceiling height of 8 feet is widely advocated, an increased height would greatly enhance the activity. (See Chapter 6.)

The outdoor small-bore rifle range requires a shooting distance of 300 feet, with the same space needs between targets and behind the firing line as specified above for the indoor range. Space needs behind the target depend on the kind of target and bulletstops used. Because of the danger of occasional ricocheting bullets, this facility must be located in an isolated area, or bulletstops of armor plate must be constructed which will effectively trap the entire slug.

Ranges for high-powered rifle shooting for all official distances require firing lines at 200, 300, 600, 800, and 1,000 yards. Safety requirements demand much greater spaces, and more effective facilities must be provided for trapping the slugs.

ORIENTATION

The indoor range requires plenty of light and the absence of glare from the sun or artificial light. The outdoor range must be so arranged that shooters will not be firing toward the direction of the sun. When target areas are north of firing lines, this requirement is normally satisfied. If prevailing winds are a factor, provisions are needed to shield the area as a means of reducing the nuisance created by flying dirt, debris, and burned gunpowder.

BULLETSTOPS

The indoor range utilizes armor plate as a means of trapping the slug and shielding the entire area—sides, top, rear, and bottom. Bullet traps are available commercially. Guesswork and trial-and-error planning should not be part of the planning process where these requirements are concerned. Authoritative assistance must be utilized.

TARGETS

Target carriers which utilize cables and pulley wheels are necessary for the small-bore and pistol ranges. Target racks and safety pits are used for the large-bore rifle range.

LIGHTING

A minimum of 50 footcandles is needed for proper lighting on firing lines, while 70 footcandles is necessary on target areas.

HORSEBACK-RIDING FACILITIES

Man's interest in horses for use in recreation has led to the demand on many campuses for facilities and programs of recreation and instruction in horseback riding. While the accommodation of this interest demands much effort and financial expenditure, the activity is worthy of inclusion where the interest is sufficiently strong.

OFF-CAMPUS AREAS

One university has a fine horseback-riding facility which includes heated stables, an indoor arena, an outdoor ring, and miles of riding trails. Another institution, on the other hand, has a fine working arrangement with a local riding academy which owns the facility and horses, and provides instruction and bus transportation for an established fee paid by the student. A third institution has made available for organized student use the needed space and facilities for a riding and rodeo club. The horses are owned and cared for by individual students. The rodeo club is a University-sponsored activity which includes competitive rodeo. This operation makes the activity available to students who are sufficiently interested, and it leaves to individual owners the responsibility for feeding and care of the animals. Other colleges and universities have utilized these and other plans for satisfying the need for inclusion of horseback riding in the overall program.¹

The material which follows will outline the facilities needed to serve riding classes with a maximum of 22 students. These facilities include 15 acres and involve a barn, a riding ring, an isolation corral, a feed-storage barn, a remuda night trap, and a hitching rail.

BARN

Stalls

Number: 28, with 14 on each side
Size: 10' x 12'
9' height in front, 8' in back
12 feet between stall rows
Runs: 10' x 20'

Tackroom

Size: 10' x 24'

Classroom

Size: 10' x 24'

Office suite

Size: 10' x 10'

Materials

Barn: Lumber - #3 rough, 1-inch stock
Roof - corrugated tin or aluminum
Frame - 2-inch lumber
Stalls: Bumper boards - 2" x 10"
Dutch doors - 3-1/2 feet wide
Runs: 10' x 20' for each stall
Posts - railroad ties
1-inch cable, 3 strands with turnbuckle on each end

Feeders

Size: 6' deep hay-feeder type
Grain boxes - 2' x 3'

General

Cement foundation with 8-inch footings
3 sides and one-half back on each stall
Plumbing to include 1-inch pipe with water spigot and tank for each stall
Electric wiring and fixtures for tackroom, classroom, barn, and the head of each stall

RIDING RING

Size: 150' x 300'

Materials

Railroad ties and 5-foot V-mesh wire with one strand of 1-inch elevation cable on top of tie; gate on each end.

¹ Among the colleges and universities with established programs and experience in this activity are St. Laurence University, the University of Colorado, New Mexico State University, Stevens College, Sweetbrier College, Mary Washington College, and State University College at Oswego (New York).

ISOLATION CORRAL

Size: 20' x 20'

Location: 100 feet from barn

Equipment: Feeder, water spigot, and tank

Materials

Railroad ties and 2-inch by 3-inch #3 lumber, capped top
Bumper boards on insides of posts for safety
Six upright posts for shelter 9 feet high in front and 8 feet high in rear
Frame roof and corrugated metal

FEED-STORAGE BARN

Size: 100' x 150' x 40' high

Capacity: 100 tons of baled hay

Materials

Telephone poles 40 feet high
2-inch rafters
Frame roof with corrugated metal

REMUDA NIGHT TRAP

Size: 150' x 300'

Materials

Railroad tie posts
V-mesh wire

HITCHING RAIL

Size: 80 feet long by 4 feet high

Materials

2-inch pipe, 4 feet high
Concrete footings spaced 6 feet apart

MISCELLANEOUS

Horses (western and/or gaited)
Saddles (western and/or English)
Bridles
Saddle pads
Grooming equipment, including 12 brushes, 12 combs, and 12 hoof picks
Hardware, including shovels, rakes, and shoeing tools
Toilet facilities in barn
One-half ton pickup
Twelve-foot stock horse trailer
Tractor with front-end loader and blade
Loading ramp
Polo mallets, balls, and ball pick-ups
Thirty-five 55-gallon water barrels

College or university administrators exploring the possibility of adding horseback riding to their programs will be well advised to study carefully the problems involved. It is a uniquely-specialized activity, and, as such, requires consultation with professional people who have had experience with it. Especially pertinent for study are: costs; location and relationships with campus and community zoning, sanitation, etc.; and the availability of continuous leadership, supervision, and animal care.

GOLF COURSES

Facilities are needed which will accommodate instructional, recreational, and competitive aspects of the golf program. Golf facilities for instruction, which are frequently located in the physical education complex, are described in Chapter 8. In addition to these kinds of facilities (driving range and/or cages, practice putting greens, and practice sand traps), each college or university desirous of promoting golf will need access to an 18-hole golf course. The

section which follows describes matters which must be considered by a college or university administration studying the feasibility of golf-course ownership.

COURSE OWNERSHIP

The golf course is an expensive facility from the standpoint of construction, operation, and maintenance. It is important, therefore, that college or university officials thoroughly study the cost factors to be sure of their ability and willingness to finance the project. An increasing number of institutions have constructed courses for use by members of their campus families, and they should be consulted concerning the problems and costs involved. In addition, the National Golf Foundation² can provide valuable assistance in the form of published surveys and expert personnel.

The following plans with respect to ownership are worthy of consideration:

- College or university ownership and operation for exclusive use by the campus family—students, faculty, and employees. This plan eliminates the problems created by joint use of a facility owned by a private or municipal body. In addition, it assures the institution that its programs will be given top priority at all times. When a college or university can foresee maximum usage of the facility and the ability to finance the project, this plan should prove far superior to any other.
- College or university ownership and operation for use by the campus family and other groups from the community-at-large. Many colleges and universities have created long-range golf-course plans which anticipate joint institution-community utilization during the early years of the project, with eventual full utilization of the course by the institution at the end of a 5- to 15-year period. In many instances, this plan seems to be the only way an institution or small community can hope to finance a project of this magnitude, and it can result in a fine experience in cooperative planning for human progress. This arrangement might continue indefinitely, or it could terminate with the construction of a second municipal course created to satisfy a greater community demand for golf facilities.
- Ownership by a private or municipal group, with the college or university entering into a contractual agreement for use of the course in connection with part or all of its golf program. This plan might prove satisfactory for all parties to the agreement, and it could be the only way many institutions will solve their program needs. There are obvious disadvantages and problems to be faced, but these can often be alleviated when people of good faith are united in an intelligent endeavor for the common good.

The publications of the National Golf Foundation which are listed at the end of this chapter include extensive and specifically-pertinent information on most of the important aspects of golf-course planning, operation, promotion, and maintenance (including actual cost experience of specific courses).

SPACE REQUIREMENTS

The good golf-course architect is an artist-scientist who needs land sufficient in amount, kind, and terrain to enable

him to carry forward his creative responsibilities in an efficient and satisfying way. It is difficult, therefore, to record a specific standard regarding space needs for the 18-hole golf course and its auxiliary services. It is generally believed that the minimum space needed is 110 acres, but 160 acres is probably a more realistic and desirable standard.³

FACILITIES FOR INCLUSION

The golf center usually includes an 18-hole golf course, a pro-manager shop and/or clubhouse, a 15- to 35-tee driving range and one or more net cages, one or more practice putting greens of 8,000 to 12,000 square feet each, a practice sand trap of 250 to 2,500 square feet, and a par-3 course. Lighting for night play is highly recommended as a means of extending use of these areas, and some utilization of artificial surfaces for practice putting and for tees should be considered as a means of withstanding heavy use.

SUMMARY

The golf course is not a facility which can be described in generalities and by rule-of-thumb standards. On the contrary, it is a highly-specialized facility which requires major study and the specialized skill of a competent golf-course architect to design it and bring it into use. The National Golf Foundation is a nonprofit organization which was organized and is operated to be of service to people and organizations in need of technical information on golf and golf facilities. Its publications and the staff of golf consultants which it employs should be utilized by college and university authorities interested in developing golf programs and facilities. In addition, institutions which have successful golf-course programs in operation should be visited for the purpose of studying the operation and consulting with the people who have actual experience with the problems to be encountered.

SNOW-SKIING FACILITIES

In recent years, there has been a great upsurge in the popularity of snow skiing. As a result, numerous colleges and universities have added skiing instruction to the physical education program.

One of several approaches may be taken to this phase of the program, depending on the particular local circumstances. The following approaches, which are currently being used at various institutions, should be considered by colleges and universities contemplating the inauguration of a skiing program:

- Construction of an instructional area on campus. On some campuses, natural slopes exist which can be converted to an instructional area. In other cases, slopes have been built from fill left over from other projects.
- Construction of an instructional area off the campus, but close to it, where a satisfactory natural slope already exists.
- Purchase or development of a ski complex away from the campus which will serve as an instructional area and also as a recreational-skiing area for both students and the general public. This would be a combined commercial and instructional area controlled by the college or university.

² National Golf Foundation, Room 804, Merchandise Mart, Chicago, Ill. 60654.

³ National Golf Foundation, *Planning and Building the Golf Course*, The Foundation, Chicago, 1967. (This publication also includes valuable discussion on most of the pertinent problems of golf-course planning.)

OFF-CAMPUS AREAS

- Teaching of the instructional program at a privately-owned commercial ski area. Usually, special arrangements can be made on lift fees and other matters relating to the program.
- Teaching of only the basic fundamentals on the small slope on or near campus, and teaching the more advanced techniques, requiring more challenging terrain, at an off-campus commercial area.

Obviously, if the program is conducted off the campus, transportation arrangements must be made for both students and instructors. Usually, this requires hiring commercial buses, which adds considerably to the cost of the program. Still, it is often the most desirable approach.

CHARACTERISTICS OF A SKI SLOPE FOR INSTRUCTION

Following are some important characteristics to consider in the selection of a ski slope to be used for instruction:

- **Terrain and Slope** - Each stage of instruction (beginning, intermediate, and advanced) requires different skiing terrain. The most basic fundamentals of skiing, for instance, can be taught on a level surface. As skiers become more advanced, a larger area and a more challenging terrain should be provided. Instruction at the beginning level calls for a relatively gradual incline with an unobstructed run-out at the bottom. The needed width of the slope depends on the number of skiers using it at one time. Variety in steepness ranging from 0 to 15 percent grade is desirable. Instruction at the intermediate level calls for a larger total area with a variety of terrain and slopes ranging from 5 to 30 percent grade. A wide-open run-out at the bottom is not so essential for this level of skiers. Advanced skiers need terrain which offers them significant challenge and variety. They learn faster and enjoy instruction more on larger, well-developed skiing areas.
- **Snow** - The necessary snow depth depends on how manicured the surface is under the snow. With very smooth surfaces, such as turf, skiing can be effective on 4 to 6 inches of snow. On some rough mountain surfaces, 4 to 5 feet is needed. Sometimes leveling and manicuring the slope can extend the ski season significantly. In some locales, where snow depth is not consistently adequate, snow-making machines have been used to supplement the natural snow. Current information on how to obtain or construct such machines can be obtained from the United States Ski Association (see Appendix F). How long a given amount of snow will last depends, of course, on the temperature and the kind of snow (wet, dry, etc.). The amount of skiing is also a factor. With excessive skiing, a limited amount of snow will "wear out" (melt as a result of friction from the skis sliding over it).
- **Tows and Lifts** - Several types of ski tows and lifts are available. Among them are rope tows, pama, T-bar, single-chair, double-chair, and gondola-type lifts. For short and relatively gradual slopes, the rope, pama, or T-bar type is customarily used. Chair and gondola-type lifts are installed on steeper and larger slopes. The amount of use the area will receive will strongly influence the type of tow or lift installed, because some lifts are very complex and expensive to construct. The safety of the skiers should be a prime consideration in determining the type of tow or lift to be used.
- **Lights** - At some ski areas, lights are installed to enable night skiing. If the demand is great, and the snow adequate to handle additional use, then lights may increase the usefulness of the area significantly.
- **Safety** - The ski area must be constructed and managed with safety in mind. An adequate number of persons prepared to care for possible injuries must always be available when the area is in operation. The amount and type of safety equipment necessary for the particular ski area must be available at the area. For details on safety equipment and procedures, contact the National Ski Patrol System.⁴

⁴ National Ski Patrol System, Inc., 828 Seventeenth St., Denver, Colo.

SELECTED REFERENCES

Delamater, James B., *The Design of Outdoor Physical Education Facilities for Colleges and Schools*. New York: Bureau of Publications, Teachers College, Columbia University, 1963.

Division for Girls' and Women's Sports, *Archery-Riding Guide*, Washington, D.C.: American Association for Health, Physical Education, and Recreation, 1201 Sixteenth St., N.W. (Current Year)
Bowling-Fencing-Golf Guide. Washington, D.C.: AAHPER. (Current Year)

Golf Instructor's Guide and Golf Operator's Handbook. Chicago: National Golf Foundation, Inc., 804 Merchandise Mart, 60654.

Organizing and Operating Public Golf Courses. Chicago: National Golf Foundation, 1967.

Planning and Building the Golf Course. Chicago: National Golf Foundation, 1967.

Planning Information for Private Golf Clubs. Chicago: National Golf Foundation, 1967.

APPENDIX A

NATIONAL CONFERENCE ON FACILITIES FOR HEALTH, PHYSICAL EDUCATION, AND RECREATION

SPONSORING ORGANIZATIONS

American Association for Health, Physical Education, and Recreation Caswell M. Miles	The Athletic Institute Laurence A. Mullins	National Council on Schoolhouse Construction John L. Cameron
American Association of School Administrators Jordan L. Larson		National Education Association Jackson M. Anderson
American Camping Association Reynold E. Carlson		National Federation of State High School Athletic Associations David C. Arnold
Association of College Unions— International Loren V. Kottner		National Recreation and Park Association Joseph Prendergast
National Association for Physical Education of College Women Leona Holbrook		Society of State Directors of Health, Physical Education, and Recreation Harold K. Jack
National College Physical Education Association for Men Harold E. Kenney		School Facilities Council of Architecture, Education, and Industry Jordan L. Larson

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CHAIRMAN
Caswell M. Miles
Planning Associates
Voorheesville, New York

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University of Minnesota
Minneapolis, Minnesota

TREASURER
Laurence A. Mullins
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Chicago, Illinois

CONFERENCE DIRECTOR
Harold K. Jack
Temple University
Philadelphia, Pennsylvania

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Jackson M. Anderson, University of Minnesota, Minneapolis,
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John M. Cooper, Indiana University, Bloomington, Indiana
Samuel M. Cooper, Bowling Green State University, Bowling
Green, Ohio
George F. Cousins, Indiana University, Bloomington, Indiana
Prudence Fleming, Temple University, Philadelphia, Penn-
sylvania
S. L. Fordham, University of Illinois at Chicago Circle, Chica-
go, Illinois
Leona Holbrook, Brigham Young University, Provo, Utah
Harold K. Jack, Temple University, Philadelphia, Pennsylvania
Clayne Jensen, Brigham Young University, Provo, Utah

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John J. Kirk, New Jersey State School of Conservation,
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James W. Long, Oregon State University, Corvallis, Oregon
Lloyd Messersmith, Southern Methodist University, Dallas,
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Caswell M. Miles, Planning Associates, Voorheesville, New
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Cecil W. Morgan, Ithaca College, Ithaca, New York
Laurence A. Mullins, The Athletic Institute, Chicago, Illinois
J. Keogh Rash, Indiana University, Bloomington, Indiana
Armond H. Seidler, University of New Mexico, Albuquerque,
New Mexico

APPENDIX B

PARTICIPANTS IN THE FOURTH NATIONAL FACILITIES CONFERENCE

Biddle Continuing Education Center

Indiana University, Bloomington

April 29-May 8, 1967

Aitken, Margaret H.—Chairman, Department of Physical Education for Women, Western Washington State College, Bellingham, Washington.

Aldrich, Anita—Chairman, Department of Physical Education for Women, Indiana University, Bloomington, Indiana.

Anderson, Jackson M.—Chairman, Department of Recreation and Park Administration, University of Minnesota, Minneapolis, Minnesota.

Ashton, Dudley—Chairman, Department of Physical Education for Women, University of Nebraska, Lincoln, Nebraska.

Bischoff, David C.—Associate Dean, School of Physical Education, University of Massachusetts, Amherst, Massachusetts.

Bushore, Donald E.—Regional Director, The Athletic Institute, Chicago, Illinois.

Carlson, Reynold E.—Professor of Recreation and Park Administration, Indiana University, Bloomington, Indiana.

Christiansen, Holger—Athletic Finance and Facilities Coordinator, University of Minnesota, Minneapolis, Minnesota.

Cooper, John M.—Director of Graduate Studies, School of Health, Physical Education, and Recreation, Indiana University, Bloomington, Indiana.

Cooper, Samuel M.—Chairman, Department of Health and Physical Education, Bowling Green State University, Bowling Green, Ohio.

Counsilman, James E.—Professor of Physical Education and Swimming Coach, Indiana University, Bloomington, Indiana.

Cousins, George F.—Professor of Physical Education, Indiana University, Bloomington, Indiana.

Delamater, James B.—Head, Department of Physical Education, New Mexico State University, Las Cruces, New Mexico.

Duncan, Margaret M.—Head, Department of Physical Education for Women, Northern Illinois University, DeKalb, Illinois.

Fleming, Prudence—Associate Professor of Physical Education, Temple University, Philadelphia, Pennsylvania.

Fordham, S. L.—Director, Division of Physical Education and Athletics, University of Illinois at Chicago Circle, Chicago, Illinois.

Heffington, Marvin D.—Supervisor of Men's Intramural Activities, University of Illinois, Urbana, Illinois.

Holbrook, Leona—Chairman, Department of Physical Education for Women, Brigham Young University, Provo, Utah.

Jack, Harold K.—Chairman, Department of Health, Physical Education, and Recreation, Temple University, Philadelphia, Pennsylvania.

Jensen, Clayne—Professor, College of Physical Education, Brigham Young University, Provo, Utah.

Karl, John H.—Assistant Intramural Director, Purdue University, Lafayette, Indiana.

Kirk, John J.—Director, New Jersey State School of Conservation, Branchville, New Jersey.

Long, James W.—Director, Division of Physical Education, Health, and Recreation, Oregon State University, Corvallis, Oregon.

Loveless, James C.—Director of Physical Education and Athletics, DePauw University, Greencastle, Indiana.

Messersmith, Lloyd—Chairman, Department of Physical Education and Health, Southern Methodist University, Dallas, Texas.

Miles, Caswell M.—Planning Associates, Voorheesville, New York.

Montoye, Henry J.—Professor of Physical Education and Research Associate in Epidemiology, University of Michigan, Ann Arbor, Michigan.

Morgan, Cecil W.—Dean, School of Health and Physical Education, Ithaca College, Ithaca, New York.

Mueller, Robert—Assistant to the President, Ithaca College, Ithaca, New York.

Mullins, Laurence A.—President, The Athletic Institute, Chicago, Illinois.

O'Connor, Burton L.—Professor of Health, Physical Education, and Athletics, Illinois State University, Normal, Illinois.

Pease, Esther E.—Associate Professor of Physical Education, University of Michigan, Ann Arbor, Michigan.

Rash, J. Keogh—Chairman, Department of Health and Safety Education, Indiana University, Bloomington, Indiana.

Seagers, Paul W.—Professor of Education and School Building Consultant, Indiana University, Bloomington, Indiana.

Seidler, Armond H.—Chairman, Department of Health, Physical Education, and Recreation, University of New Mexico, Albuquerque, New Mexico.

Smith, Julian W.—Professor of Education and Director, AAHPER Outdoor Education Project, Michigan State University, East Lansing, Michigan.

Thiel, Glenn N.—Administrative Assistant to the Dean, College of Health and Physical Education, Pennsylvania State University, University Park, Pennsylvania.

APPENDIX C

NONPARTICIPANTS WHO CONTRIBUTED TO ADVANCE PREPARATION OF MATERIALS FOR THE FOURTH NATIONAL FACILITIES CONFERENCE

Bookwalter, Karl W.—Indiana University, Bloomington, Indiana.

Brown, Roscoe—New York University, New York, New York.

Bruce, Benjamin F.—Indiana University, Bloomington, Indiana.

DeLuca, Eugene—Ithaca College, Ithaca, New York.

Deppe, Theodore R.—Indiana University, Bloomington, Indiana.

DeVries, Herbert—University of Southern California, Los Angeles, California.

Geddes, David D.—Brigham Young University, Provo, Utah.

Grant, Robert—Ithaca College, Ithaca, New York.

Haniford, George W.—Purdue University, Lafayette, Indiana.

Harding, Carol—Michigan State University, East Lansing, Michigan.

Hartvigsen, Milton F.—Brigham Young University, Provo, Utah.

Herrscher, Barton—University of California at Los Angeles, Los Angeles, California.

Kenney, Harold E.—University of Illinois, Urbana, Illinois.

Matthews, Donald—Ohio State University, Columbus, Ohio.

Morehouse, Laurence—University of California at Los Angeles, Los Angeles, California.

Myhre, Loren G.—Indiana University, Bloomington, Indiana.

Nickeson, Ronald—Ithaca College, Ithaca, New York.

Nugent, Timothy—University of Illinois, Urbana, Illinois.

Rarick, Lawrence—University of Wisconsin, Madison, Wisconsin.

Slater-Hammel, Arthur T.—Indiana University, Bloomington, Indiana.

Wells, Gardner E.—State University College, Oswego, New York.

Zabik, Roger M.—Indiana University, Bloomington, Indiana.

APPENDIX D

PARTICIPANTS IN PREVIOUS NATIONAL FACILITIES CONFERENCES

First National Facilities Conference Participants

Jackson's Mill, West Virginia, December 1-15, 1946

Abernathy, Ruth
Andrews, Robert
Ashcraft, J. Holley
Ayars, George W.
Bank, Theodore P.
Barrett, Lewis R.
Beaghtler, Amos L., M.D.
Bookwalter, Carolyn
Bookwalter, Karl
Butler, George D.
Camp, Marjorie
Christiansen, Milo F.
Dane, C. Wesley

Everly, Robert
Ferguson, Thomas C.
Forsythe, Charles E.
Gable, Martha
Gregg, Leah J.
Hadden, Gavin
Hamon, Ray L.
Hay, William H.
Hernlund, Vernon F.
Hilton, Ernest
Hughes, William L.
Hyatt, Chauncey A.
Jeffers, T. C.

Jones, Clayton
Jones, Grace
Lensch, Dorothea M.
Luehring, F. W.
Manley, Helen
McClintock, Ralph
McGowan, E. T.
Miles, Caswell M.
Miller, Ben W.
Nordly, Carl L.
Oppermann, Paul
Petticord, B. R.
Pritzlaff, August H.

Romney, G. Ott
Roy, Walter
Schooler, Virgil
Scott, Harry A.
Stafford, Frank S.
Streit, William K.
Tarrant, Julian W.
Trent, W. W.
Van Horn, Paris J.
Wilson, Charles C., M.D.

Second National Facilities Conference Participants

Michigan State University, East Lansing, May 4-12, 1956

Anderson, Jackson M.
Ashcraft, J. Holley
Bachman, William E.
Bank, Theodore P.
Barrett, Lewis R.
Bishop, Thelma D.
Champlin, Ellis H.
Christiansen, Milo F.
Coe, Merrell A.
Coleman, Helen L.
Cooper, Shirley
Daniels, Arthur S.
Daubert, Russell B.

Deach, Dorothy F.
Dexter, Genevieve
Doell, Charles E.
Elmer, Arthur C.
Forsythe, Charles E.
Gabrielsen, Milton A.
Graves, Charles M.
Guillaume, Harold B.
Hernlund, Vernon F.
Herrick, John H.
Hughes, William L.
Jack, Harold K.
Jones, Thomas H.

Landis, Paul E.
Lensch, Dorothea M.
Leu, Donald J.
Mathewson, F.S.
McGowan, E. T.
McNeely, Simon
Miles, Caswell M.
Packard, Marion V.
Pritzlaff, August H.
Rash, J. Keogh
Rice, Edwin G.
Scott, Harry A.
Sharp, L. B.

Smith, Julian W.
Streit, William K.
Svoboda, Robert L.
Taylor, J. L.
Terry, William L.
Verhulst, Lucille H.
Vernier, Elmon L.
Westkaemper, Richard B.
Whorlow, Merl I.
Woolridge, James D.
Yoho, Robert

Third National Facilities Conference Participants

Indiana University, Bloomington, January 15-24, 1965

Aldrich, Anita
Anderson, Jackson M.
Arnold, David C.
Bank, Theodore P.
Bartelma, David C.
Beazely, A. E.
Benedict, Paul H.
Berke, Ira
Bookwalter, Carolyn
Bookwalter, Karl W.
Bradley, Neil
Butler, George D.
Cameron, John L.
Carlson, Reynold E.
Chapman, Frederick M.
Costello, Milton

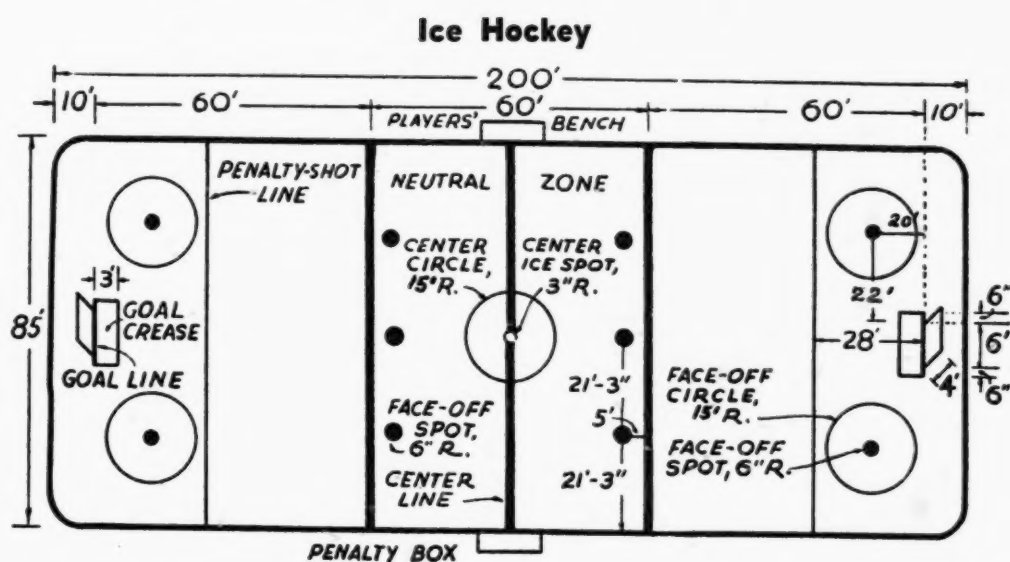
Counsilman, James E.
Cousins, George F.
Crawford, Robert W.
Daniels, Arthur S.
Dhainin, Felix K.
Gabrielsen, Milton A.
George, Jack F.
Graves, Charles M.
Hartvigsen, Milton
Haynes, Evan
Hebel, Everett L.
Hester, Oka T.
Holbrook, Leona
Hughes, Wayne
Jack, Harold K.
Kaplan, Robert

Kenney, Harold E.
Kottner, Loren V.
Krueger, Charles E.
Lengfeld, Fred
Loft, Bernard I.
McCarthy, Robert E.
McLelland, Malcolm J.
Miles, Caswell M.
Millman, David
Mittelstaedt, A. H., Jr.
Nugent, Timothy
Perkins, James
Perry, Russell
Porter, William
Rash, J. Keogh
Robertson, David H.

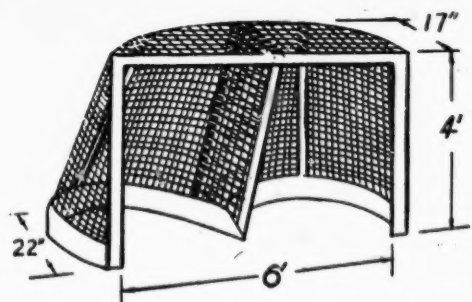
Seagers, Paul W.
Seidler, Armond H.
Skea, Graham M.
Smith, Julian W.
Spain, James M.
Stein, Thomas A.
Van Morgan, Harold
Ver Lee, Jay M.
Vye, Lloyd
Wargo, Joseph B.
Westkaemper, R. B.
Wilson, Ralph C.
Yoho, Robert

APPENDIX E

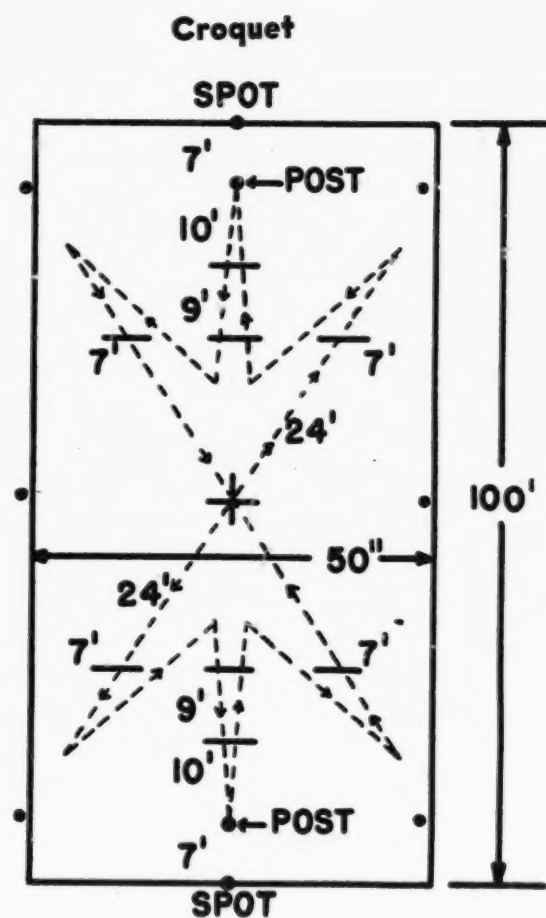
ATHLETIC FIELD AND COURT DIAGRAMS



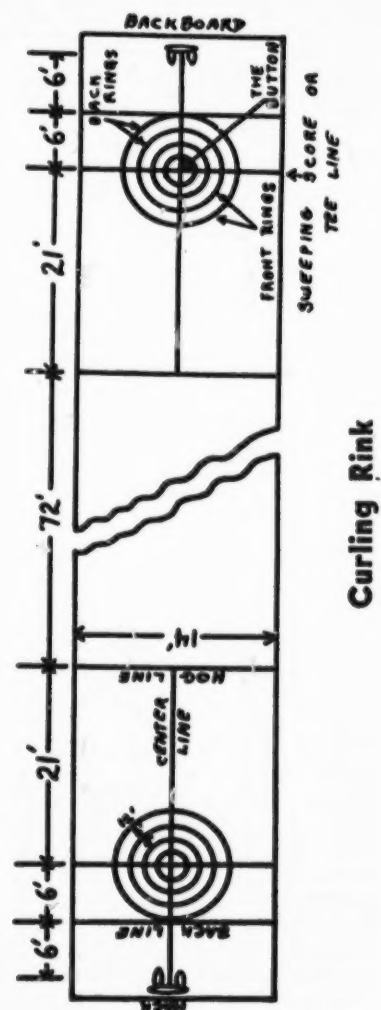
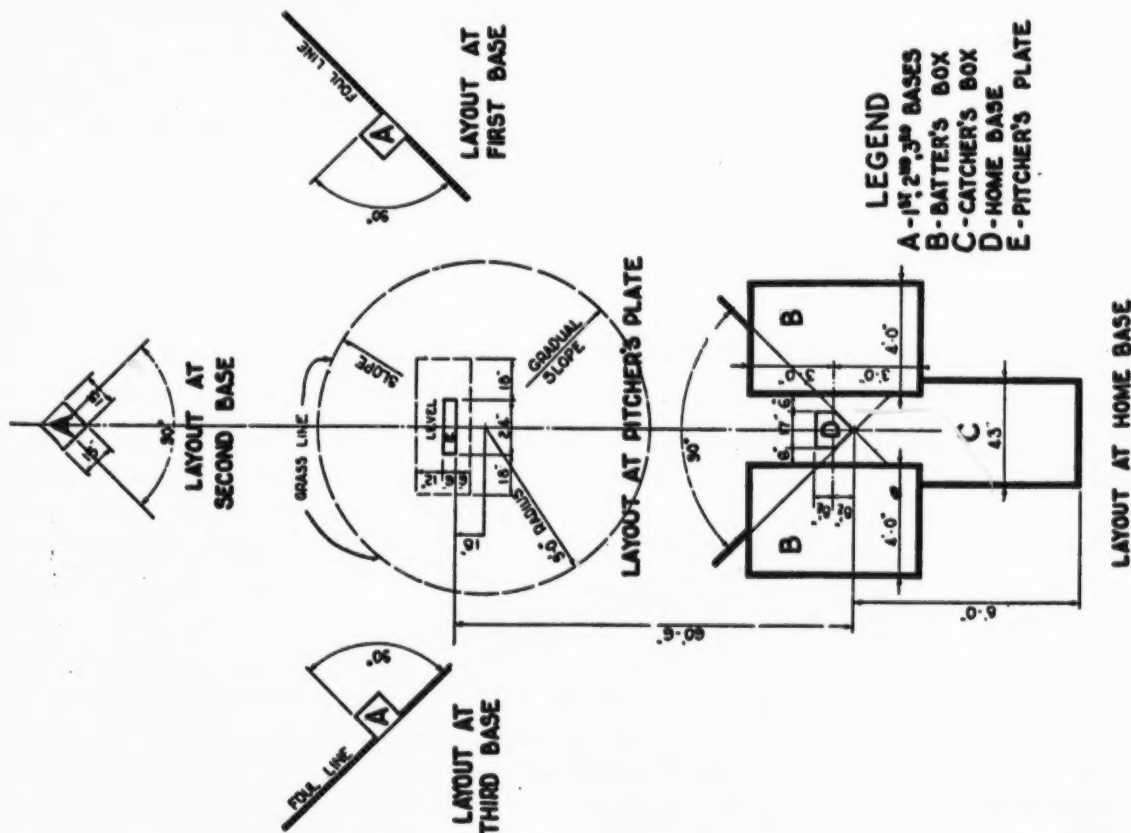
Players' Seats or Benches. Should have a seating capacity of 14, be placed directly alongside ice, as close to center line as possible, and adjacent to dressing rooms.



The "Art Ross" goal net, used by the National Hockey League.



Baseball



ATHLETIC FIELD AND COURT DIAGRAMS

Speedball

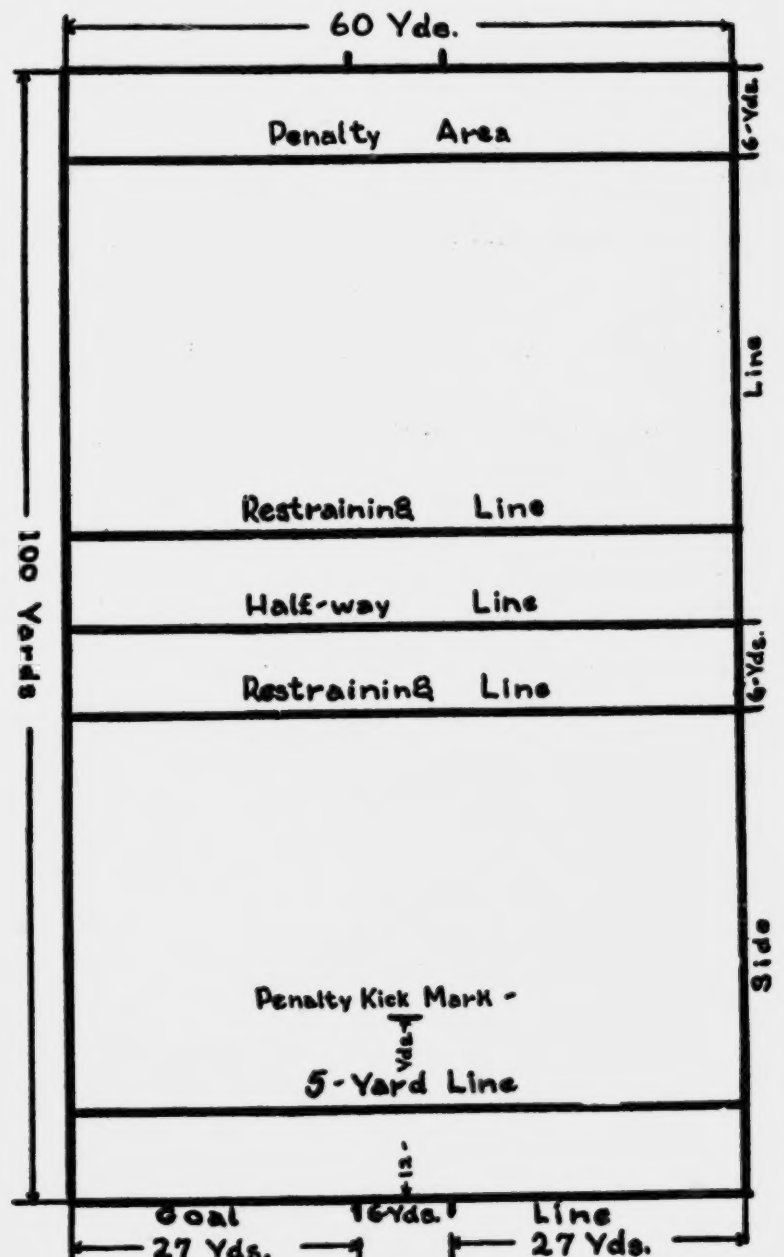
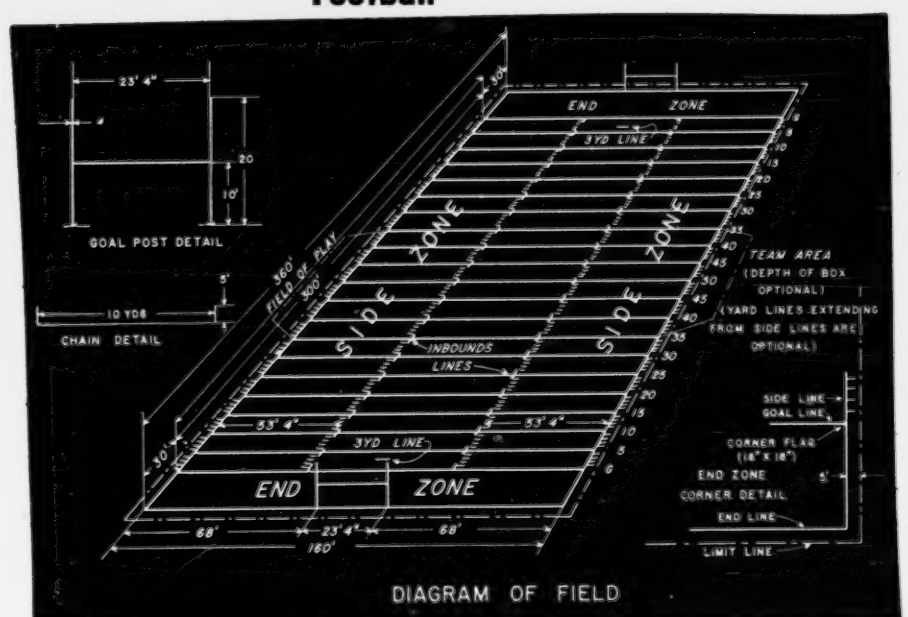


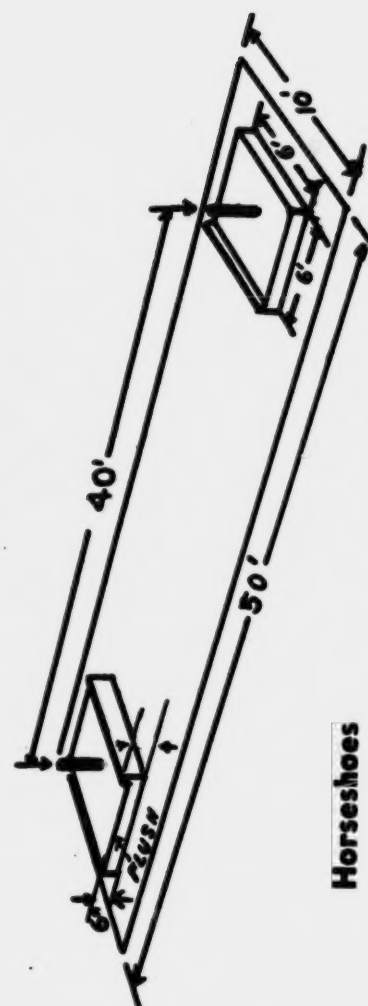
DIAGRAM OF SPEEDBALL FIELD

Football

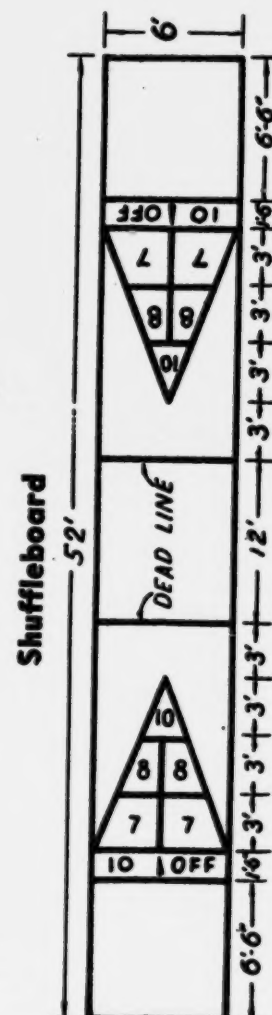


ATHLETIC FIELD AND COURT DIAGRAMS

BASKETBALL COURT DIAGRAM

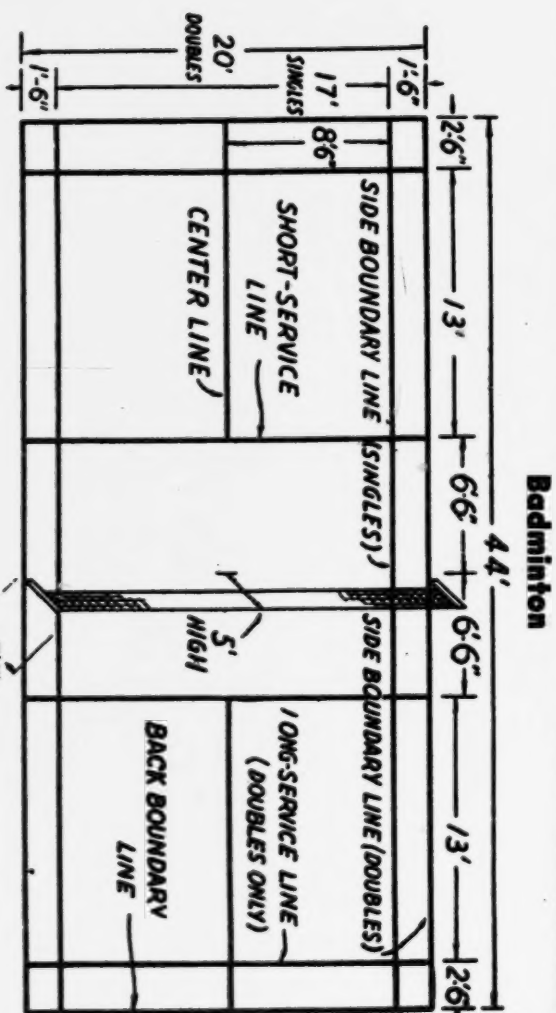
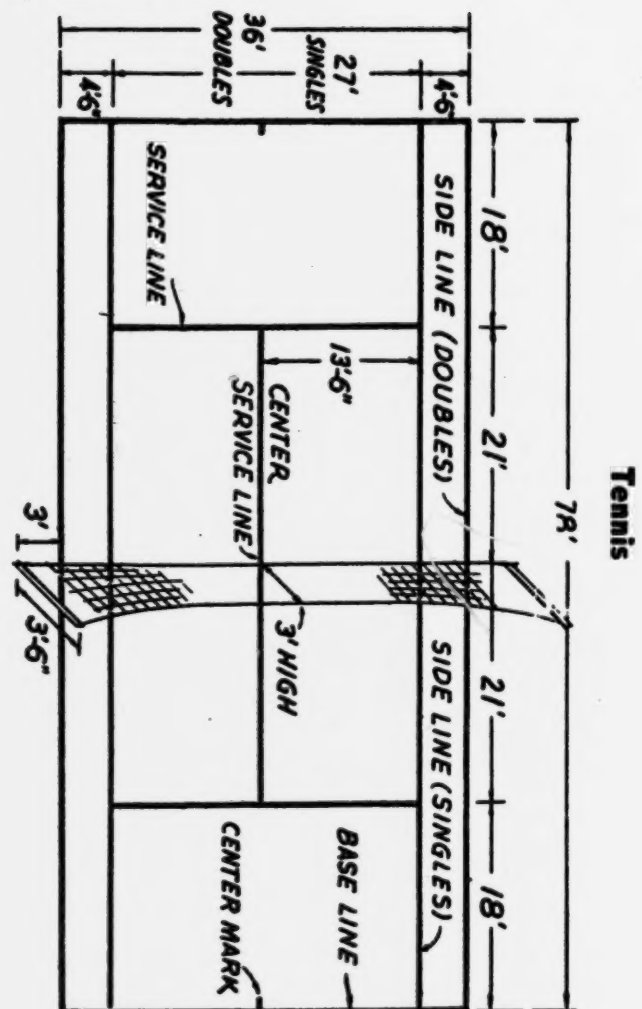


Right End Shows Small Backboard for High School and Y.M.C.A. Games.



APPENDIX E

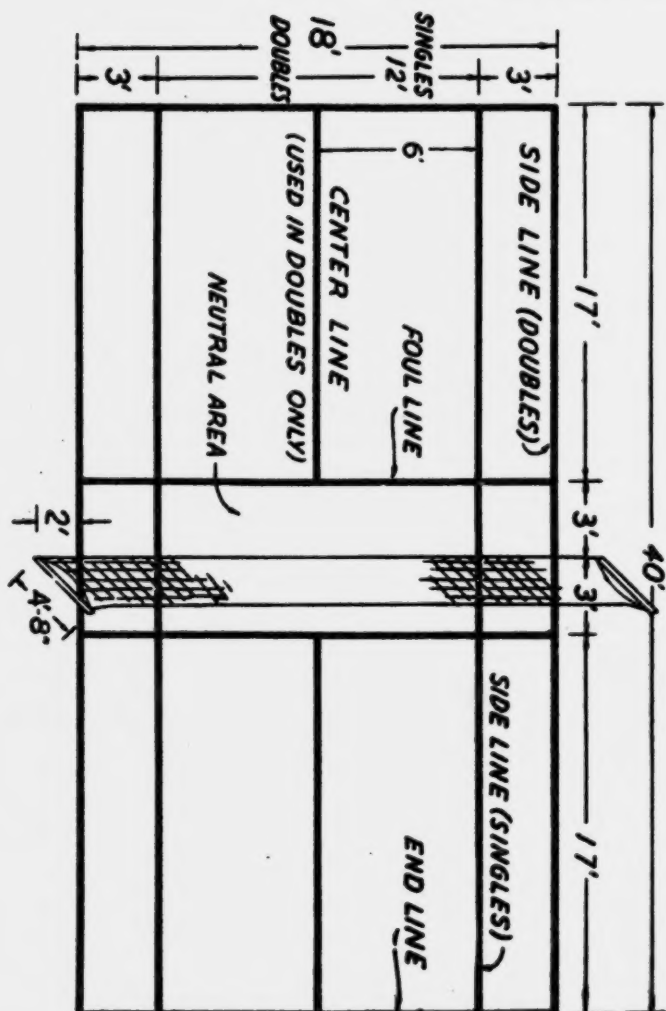
ATHLETIC FIELD AND COURT DIAGRAMS



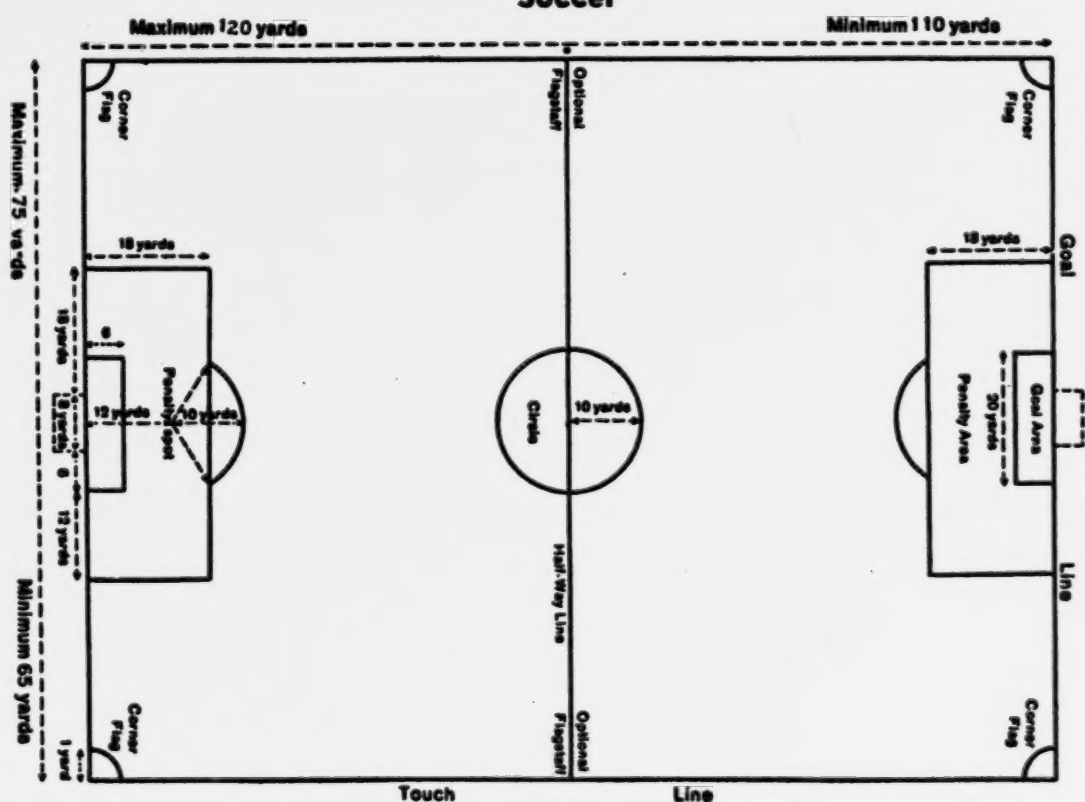
Deck Tennis

Dimensions and Specifications from "Sport for the Fun of It" and "Active Games and Contests"

Over-all Court Dimensions. Doubles—18' x 40'. Singles—12' x 40'.

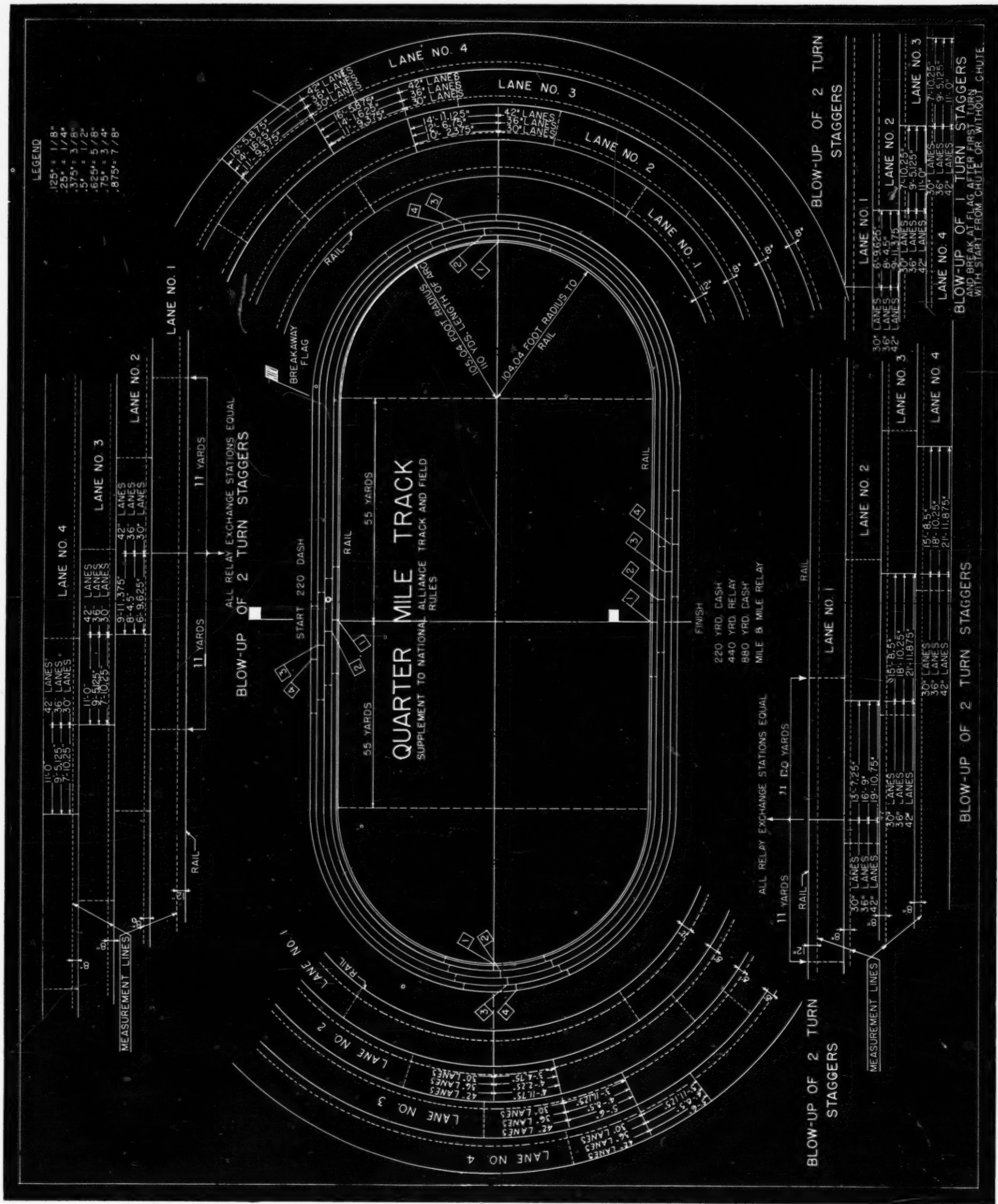


Soccer



APPENDIX E

ATHLETIC FIELD AND COURT DIAGRAMS



APPENDIX F

SOURCES OF OFFICIAL RULES

Many sporting goods stores carry rule books on a wide variety of sports. Check your local sporting goods store when in need of them. If you are unable to obtain the books you are seeking from local authorities, they may be obtained by writing to the following sources. To save time, it might be well to enclose payment with your order. (Note: Prices subject to change. Some prices include mailing charges.)

The following list is not all-inclusive. Therefore, The Athletic Institute would appreciate receiving information which will make this list more complete, or which will help correct such data as may become outdated.

THE ATHLETIC INSTITUTE
MERCHANDISE MART, ROOM 805
CHICAGO, ILLINOIS 60654

ACTIVITY	SOURCE OF RULES	COST
Aerial Tennis	Sells Aerial Tennis Co. Box 42, Kansas City, Kan., 66103	(free)
Archery (Field)	National Field Archery Assn. Rt. 2, Box 514, Redlands, Calif., 92373	\$2.00
Archery (Target)	National Archery Assn. 23 E. Jackson Blvd., Chicago, Ill. 60604	\$1.25
Archery (Indoor)	American Archery Council 23 E. Jackson Blvd., Chicago, Ill., 60604	\$.75
Archery (See DGWS listing)		
Badminton	American Badminton Assn., Alfred W. Hayes, 10552 Almayo Ave., Los Angeles, California 90064	\$.25
Badminton	Dayton Racquet Co., 302 S. Albright St., Arcanum, Ohio 43504	(free)
Badminton (See DGWS listing)		
Banball (Rules included)	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Baseball (Nonprofessional) Guide (Annual w/rules)	National Baseball Congress, Wichita, Kansas	\$1.75
Baseball (Copyrighted Rules)	National Baseball Congress, Wichita, Kansas	\$.25
Baseball (American Legion)	American Legion, Box 1055, Indianapolis, Ind., 46206	\$.25 OR 5 FOR \$1.00
Baseball, Babe Ruth League	Babe Ruth League, Inc. 524 1/2 Hamilton Ave., Trenton, N.J. 08609	(free)
Baseball (Khoury League)	George Khoury Baseball, 3222 Park Ave., St. Louis, Mo.	(free)
Baseball, Little League	Little League Baseball, Inc. P.O. Box 925, Williamsport, Pa. 17704	\$.15
Baseball, Little League (Umpire's Handbook)	Little League Baseball, Inc. P.O. Box 925, Williamsport, Pa. 17704	\$.25
Baseball, Bronco-Pony-Colt	Boys Baseball, Inc., P.O. Box 225, Washington, Pa. 15301	(free)
Baseball "Knotty Problems of Baseball" (Professional Rules)	The Sporting News, 2018 Washington Ave., St. Louis, Mo. 63166	\$2.00
Baseball (Professional Rules Only)	The Sporting News, 2018 Washington Ave., St. Louis, Mo. 63166	\$.50
Baseball (See NCAA listing)		
Baseball Umpire's Handbook (Does not include actual rules)	American Amateur Baseball Congress 216 Plaza Building, 2855 W. Market St., P.O. Box 5332, Akron, Ohio 44313	\$1.00
Baseball Scorer's Handbook (Does not include actual rules)	American Amateur Baseball Congress 216 Plaza Building, 2855 W. Market St., P.O. Box 5332, Akron, Ohio 44313	\$.50
Baseball, Rules in Pictures	American Amateur Baseball Congress 216 Plaza Building, 2855 W. Market St., P.O. Box 5332, Akron, Ohio 44313	\$1.00
Baseball, Tournament Manual	American Amateur Baseball Congress 216 Plaza Building, 2855 W. Market St., P.O. Box 5332, Akron, Ohio 44313	\$1.00
Baseball, League Organization	American Amateur Baseball Congress 216 Plaza Building, 2855 W. Market St., P.O. Box 5332, Akron, Ohio 44313	\$.35
Baseball (See High School listing)		
Basketball Balanced (Height Equalization)	John L. McHale, 4 Montgomery Road, Scarsdale, New York 10583	\$.50
Basketball (See AAU listing)		
Basketball (See High School listing)		
Basketball (See NCAA listing)		
Basketball (See DGWS listing)		
Basketball (Biddy)	Jay Archer, 701 Brooks Building, Scranton, Pa., 18501	\$.10
Bicycling	Bicycle Institute of America, 122 E. 42nd St., New York, N.Y. 10017	(free)
Billiards (Rules & Records)	Billiard Congress of America, 20 N. Wacker Dr., Chicago, Ill. 60606	\$1.25

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ACTIVITY	SOURCE OF RULES	COST
Bocce	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Bocce	Lignum-Vitae Products Corp., 96 Boyd Ave., Jersey City, N.J. 07304	(free)
Bowling (Duck Pin)	National Duck Pin Bowling Congress 1420 New York Ave., N. W., Washington, D.C. 20005	(free)
Bowling (Ten Pin)	American Bowling Congress 1572 E. Capitol Dr., Milwaukee, Wisc. 53211	\$.25
Bowling, Womens (Ten Pin)	Women's International Bowling Congress, Inc. 1225 Dublin Rd., Columbus, Ohio 43212	(free)
Bowling (See DGWS listing)		
Boxing (See AAU listing)		
Casting (Official Rules for Fly and Bait Casting)	American Casting Education Foundation P.O. Box 51, Nashville, Tenn. 37202	
Corkball	Rawlings Sporting Goods Co. 2300 Delmar Blvd., St. Louis, Mo. 63166	(free)
Croquet	General Sportcraft Co., Ltd. 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Dartball	Wisconsin State Dartball Comm. 9333 W. Lincoln Ave., West Allis, Wisc. 53214, c/o E. Dorow, Pres.	\$.40
Darts	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Deck Tennis	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Fencing	Amateur Fencer's League of America William Latzko, P.O. Box 144, Terre Haute, Ind. 47808	\$3.00
Fencing (See DGWS listing)		
Field Hockey (See DGWS listing)		
Field Hockey	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Floor Tennis	U.S. Floor Tennis Assn. 1580 Sherman Ave., Evanston, Ill. 60201	(free)
Football (Junior League)	Pop Warner Football National Headquarters 1004 Western Saving Fund Bldg., Broad & Chestnut Streets, Philadelphia, Pa., 19107	\$.25
Football (Six-Man) (See High School listing)		
Foothall (See High School listing)		
Football (See NCAA listing)		
Golf	U.S. Golf Assn., 40 E. 38th St., New York, N.Y. 10016	\$.25
Gymnastics (See AAU listing)		
Gymnastics (See NCAA listing)		
Gymnastics (See DGWS listing)		
Handball (See AAU listing)		
Handball	U.S. Handball Assn. 4101 Dempster St., Skokie, Ill. 60076	\$1.00
Horseshoes	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Horseshoes (Professional)	National Horseshoe Pitchers Assn. of America Elmer Beller, 9725 Palm St., Bellflower, Calif. 90706	(free)
Ice Hockey (See NCAA listing)		
Ice Skating	Amateur Skating Union, Edward J. Schmitzer 4135 N. Troy St., Chicago, Ill. 60618	
Indoor Hockey	Cosom Corp., 6030 Wayzata Blvd., Minneapolis, Minn. 55416	\$.25
Lacrosse (See DGWS listing)		
Lawn Bowls	John W. Deist, Secretary, 1525 Ridge Court Wauwatosa, Wisc. 53213	(free)
Marbles Shooting	National Marbles Tournament Cleveland Press Bldg., Cleveland 14, Ohio	(free)
Outings (See DGWS listing)		
Paddle Tennis	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25

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ACTIVITY	SOURCE OF RULES	COST
Paddleball	Rodney J. Grambeau, Sports Bldg. University of Michigan, Ann Arbor, Mich. 48104	(free)
Quoits	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Riding (See DGWS listing)		
Roller Hockey	National Roller Hockey Assn. of the U.S. 97 Erie St., Dumont, N.J. 07628	
Roque	American Roque League, Inc. 4205 Briar Creek Lane, Dallas, Texas 75214	\$.30
Scoopball (Rules for 26 different games)	Cosom Industries, 6030 Wayzata Blvd., Minneapolis, Minn. 55416	\$.25
Shooting (See National Rifle Assn. listing)		
Shuffleboard (Deck)	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Shuffleboard (Table)	American Shuffleboard Leagues, Inc. 533 Third St., Union City, N.J. 07087	(free)
Skating (Figure)	U.S. Figure Skating Assn. 575 Boylston St., Boston, Mass. 02116	\$3.00
Skating (Roller)	U.S. Amateur Roller Skating Assn. 120 W. 42nd St., New York, N.Y. 10036	\$1.50
Skating (Speed)	Amateur Skating Union of the U.S., Edward J. Schmitzer 4135 N. Troy St., Chicago, Ill. 60618	\$1.00
Skeet Shooting	National Skeet Shooting Assn. 3409 Oak Lawn Ave., Suite 219, Dallas, Tex. 75219	\$.25
Skiing (See NCAA listing)		
Skiing (Downhill, Slalom, Giant Slalom, Jumping & Cross-Country, FIS and USSA Rules)	U.S. Ski Assn., Gloria C. Chadwick, Executive Sec'y. Broadmoor, Colorado Springs, Colo. 80906	\$2.00
Skindiving Competitive (See AAU listing)		
Smash	Smash, 1024 North Blvd., Oak Park, Ill. 60301	(free)
Soccer (See NCAA listing)		
Soccer (See DGWS listing)		
Softball (12"—fast and slow pitch)	Amateur Softball Assn., Suite 1300, Skirvin Tower Oklahoma City, Okla. 73102	\$.75
Softball (16")	Umpires Protective Assn. of Chicago, Edw. Weinstein, Chairman, Rules Committee Apt. 710, 3550 Lake Shore Dr., Chicago, Ill.	\$.60
Softball (See DGWS listing)		
Speed-A-Way	Marjorie S. Larsen, 1754 Middlefield Stockton, Calif. 95204	\$1.25
Speedball (See DGWS listing)		
Spiral Tennis	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Squash Racquets	U.S. Squash Racquets Assn. 200 E. 66th St., New York, N.Y. 10021	\$2.50
Swimming (See AAU listing)		
Swimming (See NCAA listing)		
Swimming (Synchronized—See AAU listing)		
Table Tennis	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Table Tennis (Instructions)	U.S. Table Tennis Assn. 210 Saturn Dr., North Star, Newark, Delaware 19711	\$.10
Table Tennis (Rules)	U.S. Table Tennis Assn. 210 Saturn Dr., North Star, Newark, Delaware 19711	(free)
Table Tennis (Instructions & Rules)	Nissen-Sico, 930—27th Ave., S.W., Cedar Rapids, Iowa 52404	(free)
Takraw Game	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Tennis (Includes Guide)	U.S. Lawn Tennis Assn. 51 E. 42nd St., New York, N.Y. 10017	\$2.00
Tennis (Rules Only)	U.S. Lawn Tennis Assn. 51 E. 42nd St., New York, N.Y. 10017	\$.25
Tennis (See DGWS listing)		

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ACTIVITY	SOURCE OF RULES	COST
Tennis	Dayton Racquet Co., 302 S. Albright St., Arcanum, Ohio 45304	(free)
Tennis Umpire's Manual (Includes Rules)	U.S. Lawn Tennis Assn. 51 E. 42nd St., New York, N.Y. 10017	\$.50
Tether Ball (Inflated Ball)	W. J. Voit Rubber Corp., 3801 S. Harbor Blvd. Santa Ana, Calif. 92704	(free)
Tether Ball (Inflated Ball)	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Tether Tennis	General Sportcraft Co., Ltd., 33 New Bridge Rd., Bergenfield, N.J. 07621	\$.25
Touch Football	The Athletic Institute, 805 Merchandise Mart, Chicago, Ill. 60654	\$.75
Track & Field (See AAU listing)		
Track & Field (See High School listing)		
Track & Field (See NCAA listing)		
Turf Bowling (Boccie)	Lignum-Vitae Products Corp., 96 Boyd Ave., Jersey City, N.J. 07304	(free)
Volleyball (Includes Rules)	U.S. Volleyball Assn., USVBA Printer P.O. Box 109, Berne, Ind. 46711	\$1.00
Volleyball (See DGWS listing)		
Water Polo (See AAU listing)		
Weight Lifting (See AAU listing)		
Winter Sports (See DGWS listing)		
Wrestling (See NCAA listing)		
NCAA RULE BOOKS AND GUIDES		
Baseball	\$1.00	Soccer \$1.00
Basketball	\$1.50	Swimming \$1.00
Football	\$1.50	Track & Field \$1.00
Ice Hockey	\$1.00	Wrestling \$1.00
Football Rules Interpretations	\$1.00	Gymnastics \$.75
		Skiing \$.75
DGWS OFFICIAL GUIDES FOR WOMEN'S SPORTS, INCLUDING RULES		
Aquatics	\$1.00	Volleyball \$1.00
Archery-Riding	\$1.00	Soccer-Speedball \$1.00
Basketball	\$1.00	Softball \$1.00
Bowling-Fencing-Golf	\$1.00	Track & Field \$1.00
Field Hockey-Lacrosse	\$1.00	Tennis-Badminton \$1.00
Gymnastics	\$1.00	Winter Sports & Outing Activities \$1.00
HIGH SCHOOL ACTIVITIES		
National Federation of State High School Athletic Assns. 7 S. Dearborn St., Chicago, Ill. 60603		
Basketball:	Football:	
Rules \$.40	Rules \$.40	
Casebook \$.75	Casebook \$.75	
Player Handbook \$.30	Player Handbook \$.30	
Official's Manual \$.40	Official's Manual \$.40	
Baseball:	Football, Touch Football \$.40	
Rules \$.40	Six-Man Football \$.40	
Casebook \$.75	Track & Field, Rules & Records \$.50	
Umpire's Manual \$.40		
OFFICIAL AAU RULE BOOKS AND GUIDES		
AAU Handbook \$2.00	Swimming, Water Polo & Diving \$2.00	
Basketball \$1.75	Swimming (Synchronized) \$1.50	
Boxing \$1.75	Track & Field \$2.25	
Gymnastics \$2.00	Weight Lifting \$1.50	
Handball \$1.25	Wrestling \$1.75	
Judo \$1.75		
NRA AND INTERNATIONAL SHOOTING UNION RULE BOOKS		
NRA High-Power Rifle \$.25	ISU Center-Fire Pistol \$.20	
NRA Pistol \$.25	ISU Rapid-Fire Pistol \$.20	
NRA Smallbore Rifle \$.25	ISU Running Deer \$.20	
NRA Shotgun \$.25	ISU Running Roebuck & Boar \$.20	
ISU Constitution \$.20	ISU Clay Pigeon \$.20	
ISU General Regulations \$.20	ISU Skeet \$.20	
ISU SB Rifle & Free Pistol \$.20	ISU Bound Vol. (all rules) \$2.50	
ISU Free Rifle & Army Rifle \$.20		

APPENDIX G

REQUIREMENTS OF THE AGING AND THE DISABLED

A BRIEF PHILOSOPHICAL BASIS

All individuals have the same basic socio-psychological and physical needs, regardless of age, ability or disability, nationality, race, or religion, although these might manifest themselves in different ways. All of us have been privileged to travel the avenues of self-exploration, self-identification, self-expression, self-administration, and self-discipline in order that we might identify ourselves as a part of, and apart from, the rest of the world. We have had the opportunity to try many things, some by trial and error, some with success, and others with failure. Via these routes, we have been privileged to develop a concept of self which is essential to success, to health, and to happiness.

From childhood through adulthood, those learned and enjoyable experiences which are integral parts of health, physical education, and recreation were instrumental in fulfilling our basic socio-psychological and physical needs, affording each of us a better concept of self. These are so fundamental that most of us take them very much for granted. Yet, if we look about us, we will see that these basic things, in part or whole, have been denied the majority of our disabled population, and are being denied increasing numbers of aging. These are "living experiences," not isolated, remote, or clinical services.

Everyone in our society should have the inherent right to normal education, growth experiences, and social and recreational pursuits. Society, in all its components, must play an increasingly important part in returning the disabled to their rightful places in society, and in maintaining the aging as participating members of society. Imposed isolation is degeneration—physically, mentally, emotionally, and socially.

The disabled must be prepared for the normal reciprocities of life. They must understand that if they are to have normal privileges and opportunities, they must be prepared for normal risks, hazards, and failures. We must educate and equip, not solicit or over-protect disabled individuals. The people, and the concern or the lack of concern of the people, who surround the disabled person are of major significance. It is important to note how much the public benefits from normal, objective association with the disabled.

A disability is specific. It must not necessarily be a handicap. People and things make a disability a handicap. We must regard an illness or disability as an experience in the life of a person, not a disaster. It is an intense and persistent experience which has considerable impact on one's life, but given the proper opportunities, those with an illness or a disability will relate effectively to each and every one of us the true significance, or insignificance, of this intense experience. Social interaction will result in better and more realistic understanding, rather than the presently devaluating

stereotypes now most commonly being applied to the disabled and the aging.

If health, physical education, and recreation have a purpose in the life of anyone, their purposes and objectives increase in magnitude and significance when related to the aging and the disabled, who, because of society's apathy, more than by personal desire, have been prone to inactivity and have had an excess of leisure time. Because of society's lack of understanding and foresight, they have been denied the opportunity to participate and, thereby, have been denied experiences in growth and development which are essential to a favorable end product. They have also been denied many opportunities in adulthood, and as senior citizens, which enrich our lives both personally and professionally.

Certainly, if physical fitness is important to anyone, it is proportionately more important to the person with a disability. This is particularly true of certain physical disabilities in which physical maintenance is a major problem and a major objective.

Stating it simply, we should begin with the "normal" and deviate as little as possible in programming for, and working with, the disabled.

The lack of accessibility and usability of facilities for health, physical education, and recreation has been a great deterrent to participation by the aging and the disabled.

Many administrators and professionals have not yet recognized the necessity and the desirability for planning facilities and equipment so that they will be equally usable by the "able" and the "disabled." They are not fully aware of the large numbers involved, and that these numbers are steadily increasing. They have failed to recognize the significance of this in the lives of the disabled and the aging. They are unaware of the full potential for participation that exists among the disabled and the aging. Because of the facilities in which many have had to function, they have seldom considered the various causes and manifestations of disability in their regular program concepts.

On the other hand, the disabled and the aging, over the years, have been somewhat apprehensive concerning their own abilities to participate, or they have been made to believe they could not do many things that we now know they can do, particularly if facilities and equipment are appropriately planned. They have been equally apprehensive about projecting themselves into many normal, objective, competitive, social settings, largely because of inaccessibility.

THE PROBLEM

The most frustrating of all problems to disabled and aging individuals are buildings and facilities, supposedly created for the public, that are designed in such a manner

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that they prohibit their full participation. It is equally frustrating to professional people dedicated to rehabilitation to find that architectural barriers prohibit the disabled individual, however well rehabilitated, from pursuing his aspirations, developing his talents, and exercising his skills.

Many of the disabled are afraid to venture forth because of the architectural barriers they encounter. Others have convinced themselves it is better to stay back because they feel they are a burden to others when they attempt to project themselves into normal social settings.

Although there are other problems, the one that is heard most often and the one that is presently enemy number one is inaccessibility.

In spite of forward-moving programs of physical restoration and rehabilitation, professionals in the field of rehabilitation are finding it very difficult to project clients into normal situations of education, recreation, and employment because of architectural barriers. Therefore, the problems inherent to the design of buildings and facilities quickly take on the role of "villain" and might revert the social and economic gains now evident to constructive rehabilitation.

The solution of these problems is not within the realm of professional rehabilitation workers. It must be a challenge to all architects, builders, designers, educators, engineers, manufacturers, and in all probability, legislatures and municipal leaders, with encouragement and guidance from those professionally engaged in medicine and rehabilitation. If more facilities in communities were accessible to, and usable by, the disabled and the aging, treatment centers, hospitals, and other institutions could make prudent use of these facilities, helping bridge the gap between patient and community, and helping to resolve some of the acute problems which face the patient upon discharge.

STATISTICAL SIGNIFICANCE

Alarming as it may seem, approximately one out of every seven people in our nation has a permanent physical disability. Among these cases are many different causes and manifestations of physical disability, and each has its own particular associated problems.

Contrary to what most people think, recent advancements in science and medical technology tend to magnify this problem. Medical science now makes it possible to save many lives, decrease the mortality rate at birth, and increase longevity, all of which greatly increase the numbers of individuals with permanent physical disabilities. It is further evident that the situation will get much worse before it gets better.

Also contributing to the increasing incidence of permanent physical disabilities is the advancing machine age, the continued expansion of industry, and the rapidly-increasing numbers of motor vehicles, both in total numbers and the percentage of populace ownership. Authorities anticipate over 200,000 traumatic paraplegics (individuals with spinal-cord injury resulting in both motor and sensory

paralysis and, in most instances, secondary loss of control of organs) from automobile accidents per year.

Increases in leisure time have also contributed to the instances of such disabilities as traumatic paraplegia. Swimming and boating, or other water accidents, for example, create thousands of such disabilities each year.

SOCIOECONOMIC SIGNIFICANCE

The human resources (talents and skills) among the disabled are of considerable socioeconomic significance. These human resources are still being overlooked and neglected while we bemoan our lack of qualified personnel in various areas and levels of endeavor.

A large portion of our disabled and aging have been unnecessarily institutionalized or are to be found in back rooms, protected and pampered by solicitous parents, relatives, and friends. Experiences and statistics in this regard are dynamically startling and truly sad. An unnecessarily large proportion of our disabled young people have had to be placed in hospital schools, orthopedic schools, or provided home-bound instruction. The cost per capita of such schooling is many times the cost when they are included in the regular school system. A multitude of other benefits are also to be derived by these people when they are properly included in regular schools.

WITH WHAT AND WHOM ARE WE CONCERNED?

We are basically concerned with making it possible for the great talents and resources of millions of disabled and aging individuals to be put to use for the betterment of mankind by the elimination of architectural barriers. More specifically, it has been our purpose to develop standards and specifications for all buildings and facilities used by the public so that they will be accessible and functional to the disabled and the aging.

In setting out upon this mission, it was recognized that the majority of buildings which we will be using within the next decade or two are already built. Therefore, the first problem was to determine what might be done to make accessible and functional the existing buildings which are now nonaccessible. The second task, and the simpler of the two, was the development of the standards for proper design and construction of new buildings and facilities.

SOLVING THE PROBLEM

In October 1961, the American Standards Association officially released "American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped." The cosponsors of this project were the President's Committee on the Employment of the Handicapped and The National Society for Crippled Children and Adults. Extensive research, experimentation, and development were carried on at the University of Illinois, in part under a grant made to the University by the National Society for Crippled Children and Adults. A Steering Committee was appointed and, subsequently, a Sectional

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Committee was selected, with representation from more than 50 professions, trades, governmental agencies (federal, state, and local), national societies, and national associations. The standards referred to above were carefully scrutinized by all members of the Steering and Sectional Committees. The standards were then carefully reviewed by several boards and committees of the American Standards Association. Therefore, these standards constitute a very sound basis for action on the part of all those who are, or should be, interested in this problem.

These standards are concerned with all causes and manifestations of disability. They are concerned with, and applicable to, all buildings used by the public. Although the specifications are applicable to all buildings regardless of the function of the building, they do not yet include specifications for some facilities of specific and unique purpose. They are being supplemented to include these. It should also be emphasized that these standards can and will be amended from time to time to keep pace with changing social and technological advancements.

On November 14, 1963, interested and authoritative persons met at the Athletic Institute offices to make a pilot investigation into the problems confronting the physically disabled in the use of health, physical education, and recreation facilities.

Subsequently, on February 9, 10, and 11, 1964, a workshop on this problem was held at the University of Illinois. There was broad representation among the participating personnel, which included not only those who would be able to contribute to the matter under consideration, but also those who would be instrumental in implementing these considerations.

SUMMARY

A little coordinated planning can open up many new worlds to millions of people. We are wasting shameful amounts of money and human resources because we have overlooked some relatively-simple things. We must make all buildings and facilities accessible to, and usable by, the disabled and the aging.

The disabled and the aging can be accommodated in all buildings and facilities used by the public:

- independently and without distinction
- without loss of space or function to the general public
- without significant extra cost.

All standards and specifications which are recommended to facilitate the disabled and the aging will be of benefit to everyone. The standards referred to herein can be incorporated in any type of building regardless of the basic architectural concept.

AMERICAN STANDARD SPECIFICATIONS FOR MAKING BUILDINGS AND FACILITIES ACCESSIBLE TO, AND USABLE BY, THE PHYSICALLY HANDICAPPED FOREWORD

(This Foreword is not a part of American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped. (A117.1-1961.)

This standard supplements other American Standards relating to various aspects of buildings and facilities. Its specifications, which are the result of extended and careful consideration of available knowledge and experience on this subject, are intended to present minimum requirements. They are recommended for use in the construction of all buildings and facilities and for adoption and enforcement by administrative authorities, so that those individuals with permanent physical disabilities might pursue their interests and aspirations, develop their talents, and exercise their skills.

The ASA Sectional Committee, A117, which developed this standard, had the following representation:

LEON CHATELAIN, JR., Chairman

T. J. NUGENT, Secretary

Organizations Represented

AFL-CIO

American Foundation for the Blind

American Hospital Association

American Hotel Association

American Institute of Architects

American Municipal Association

American Occupational Therapy Association

American Physical Therapy Association

American Society of Landscape Architects

American Society of Mechanical Engineers

American Society of Safety Engineers

American Vocational Association

Associated General Contractors of America

Association of Casualty and Surety Companies

Construction Specifications Institute

Federal Housing Administration

General Services Administration

Industrial Home for the Blind

Industrial Medical Association

Indoor Sports Clubs, Inc.

Institute for the Crippled and Disabled

National Bureau of Standards

National Congress of Organizations for the Physically Handicapped

National Council of Churches

National Council on Schoolhouse Construction

National Elevator Manufacturing Industry

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Organizations Represented

National Paraplegia Foundation

National Rehabilitation Association

National Safety Council

National Society for Crippled Children and Adults (sponsor)

Paralyzed Veterans of America, Inc.

Paraplegics Manufacturing Company

Plumbing Fixture Manufacturers Association

President's Committee on Employment
of the Handicapped (sponsor)

Society of Industrial Realtors

Telephone Group

United Cerebral Palsy Associations, Inc.

U.S. Conference of Mayors

U.S. Department of Health, Education and Welfare

Bureau of State Services

Children's Bureau

Division of Accident Prevention

Division of Hospital and Medical Facilities

Office of Education

Office of Vocational Rehabilitation

U.S. Department of Labor

Bureau of Employment Security

Bureau of Labor Standards

U.S. Veterans Administration

University of Illinois Rehabilitation Center

The Steering Committee:

K. Vernon Banta

Philip A. Klieger

Leon Chatelain, Jr.

T. J. Nugent

Clinton H. Cowgill

Jayne Shover

H. Dwight York

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1. Scope and Purpose

1.1 Scope

1.1.1 This standard applies to all buildings and facilities used by the public. It applies to temporary or emergency conditions as well as permanent conditions. It does not apply to private residences.

1.1.2 This standard is concerned with non-ambulatory disabilities, semi-ambulatory disabilities, sight disabilities, hearing disabilities, disabilities of incoordination, and aging.¹

1.2 Purpose. This standard is intended to make all buildings and facilities used by the public accessible to, and functional for, the physically handicapped, to, through, and within their doors, without loss of function, space, or facility where the general public is concerned. It supplements existing American Standards, and reflects great concern for safety of life and limb. In cases of practical difficulty, unnecessary hardship, or extreme differences, administrative authorities may grant exceptions from the literal requirements of this standard or permit the use of other methods or materials, but only when it is clearly evident that equivalent facilitation and protection are thereby secured.

2. Definitions

2.1 Non-ambulatory Disabilities. Impairments that, regardless of cause or manifestation, for all practical purposes, confine individuals to wheelchairs.

2.2 Semi-ambulatory Disabilities. Impairments that cause individuals to walk with difficulty or insecurity. Individuals using braces or crutches, amputees, arthritics, spastics, and those with pulmonary and cardiac ills may be semi-ambulatory.

2.3 Sight Disabilities. Total blindness or impairments affecting sight to the extent that the individual functioning in public areas is insecure or exposed to danger.

2.4 Hearing Disabilities. Deafness or hearing handicaps that might make an individual insecure in public areas because he is unable to communicate or hear warning signals.

2.5 Disabilities of Incoordination. Faulty coordination or palsy from brain, spinal, or peripheral nerve injury.

2.6 Aging. Those manifestations of the aging processes that significantly reduce mobility, flexibility, coordination, and perceptiveness but are not accounted for in the aforementioned categories.

2.7 Standard. When this term appears in small letters and is not preceded by the word "American," it is descriptive and does not refer to an American Standard approved by ASA; for example, a "standard" wheelchair is one characterized as standard by the manufacturers.

2.8 Fixed Turning Radius, Wheel to Wheel. The tracking of the caster wheels and large wheels of a wheelchair when pivoting on a spot.

2.9 Fixed Turning Radius, Front Structure to Rear Structure. The turning radius of a wheelchair, left front-foot platform to right rear wheel, or right front-foot platform to left rear wheel, when pivoting on a spot.

2.10 Involved (Involvement). A portion or portions of the human anatomy or physiology, or both, that have a loss or impairment of normal function as a result of genesis, trauma, disease, inflammation, or degeneration.

2.11 Ramps, Ramps with Gradients. Because the term "ramp" has a multitude of meanings and uses, its use in this text is clearly defined as ramps with gradients (or ramps with slopes) that deviate from what could otherwise be considered the normal level. An exterior ramp, as distinguished from a "walk," would be considered an appendage to a building leading to a level above or below existing ground level. As such, a ramp shall meet certain requirements similar to those imposed upon stairs.

2.12 Walk, Walks. Because the terms "walk" and "walks" have a multitude of meanings and uses, their use in this text is clearly defined as a predetermined, prepared-surface, exterior pathway leading to or from a building or facility, or from one exterior area to another, placed on the existing ground level and not deviating from the level of the existing ground immediately adjacent.

2.13 Appropriate Number. As used in this text, appropriate number means the number of a specific item that would be necessary, in accord with the purpose and function of a building or facility, to accommodate individuals with specific

¹ See definitions in Section 2.

APPENDIX G

disabilities in proportion to the anticipated number of individuals with disabilities who would use a particular building or facility.

EXAMPLE: Although these specifications shall apply to all buildings and facilities used by the public, the numerical need for a specific item would differ, for example, between a major transportation terminal, where many individuals with diverse disabilities would be continually coming and going, an office building or factory, where varying numbers of individuals with disabilities of varying manifestations (in many instances, very large numbers) might be employed or have reason for frequent visits, a school or church, where the number of individuals may be fixed and activities more definitive, and the many other buildings and facilities dedicated to specific functions and purposes.

NOTE: Disabilities are specific and where the individual has been properly evaluated and properly oriented and where architectural barriers have been eliminated, a specific disability does not constitute a handicap. It should be emphasized that more and more of those physically disabled are becoming participants, rather than spectators, in the fullest meaning of the word.

3. General Principles and Considerations

3.1 Wheelchair Specifications. The collapsible-model wheelchair of tubular metal construction with plastic upholstery for back and seat is most commonly used. The standard model of all manufacturers falls within the following limits, which were used as the basis of consideration:

- (1) Length: 42 inches
- (2) Width, when open: 25 inches
- (3) Height of seat from floor: 19 1/2 inches
- (4) Height of armrest from floor: 29 inches
- (5) Height of pusher handles (rear) from floor: 36 inches
- (6) Width, when collapsed: 11 inches

3.2 The Functioning of a Wheelchair

3.2.1 The fixed turning radius of a standard wheelchair, wheel to wheel, is 18 inches. The fixed turning radius, front structure to rear structure, is 31.5 inches.

3.2.2 The average turning space required (180 and 360 degrees) is 60 x 60 inches.

NOTE: Actually, a turning space that is longer than it is wide, specifically, 63 x 56 inches, is more workable and desirable. In an area with two open ends, such as might be the case in a corridor, a minimum of 54 inches between two walls would permit a 360-degree turn.

3.2.3 A minimum width of 60 inches is required for two individuals in wheelchairs to pass each other.

3.3 The Adult Individual Functioning in a Wheelchair²

3.3.1 The average unilateral vertical reach is 60 inches and ranges from 54 inches to 78 inches.

3.3.2 The average horizontal working (table) reach is 30.8 inches and ranges from 28.5 inches to 33.2 inches.

3.3.3 The bilateral horizontal reach, both arms extended to each side, shoulder high, ranges from 54 inches to 71 inches and averages 64.5 inches.

3.3.4 An individual reaching diagonally, as would be required in using a wall-mounted dial telephone or towel dispenser, would make the average reach (on the wall) 48 inches from the floor.

3.4 The Individual Functioning on Crutches³

3.4.1 On the average, individuals 5 feet 6 inches tall require an average of 31 inches between crutch tips in the normally accepted gaits.⁴

3.4.2 On the average, individuals 6 feet 0 inches tall require an average of 32.5 inches between crutch tips in the normally accepted gaits.⁴

4. Site Development⁵

4.1 Grading. The grading of ground, even contrary to existing topography, so that it attains a level with a normal entrance will make a facility accessible to individuals with physical disabilities.

4.2 Walks

4.2.1 Public walks should be at least 48 inches wide and should have a gradient not greater than 5 percent.⁶

4.2.2 Such walks should be of a continuing common surface, not interrupted by steps or abrupt changes in level.

4.2.3 Wherever walks cross other walks, driveways, or parking lots they should blend to a common level.⁷

NOTE: 4.1 and 4.2, separately or collectively, are greatly aided by terracing, retaining walls, and winding walks allowing for more gradual incline, thereby making almost any building accessible to individuals with permanent physical disabilities, while contributing to its aesthetic qualities.

4.2.4 A walk shall have a level platform at the top which is at least 5 feet by 5 feet, if a door swings out onto the platform or toward the walk. This platform shall extend at least 1 foot beyond each side of the doorway.

4.2.5 A walk shall have a level platform at least 3 feet deep and 5 feet wide, if the door does not swing onto the platform or toward the walk. This platform shall extend at least 1 foot beyond each side of the doorway.

4.3 Parking Lots

4.3.1 Spaces that are accessible and approximate to the facility should be set aside and identified for use by individuals with physical disabilities.

4.3.2 A parking space open on one side, allowing room for individuals in wheelchairs or individuals on braces and crutches to get in and out of an automobile onto a level surface, suitable for wheeling and walking, is adequate.

2 Extremely small, large, strong, or weak and involved individuals could fall outside the ranges in 3.3.1, 3.3.2, 3.3.3, and their reach could differ from the figure given in 3.3.4. However, these reaches were determined using a large number of individuals who were functionally trained, with a wide range in individual size and involvement.

3 Most individuals ambulating on braces or crutches, or both, or on canes are able to manipulate within the specifications prescribed for wheelchairs, although doors present quite a problem at times. However, attention is called to the fact that a crutch tip extending laterally from an individual is not obvious to others in heavily trafficked areas, certainly not as obvious or protective as a wheelchair and is, therefore, a source of vulnerability.

4 Some cerebral palsied individuals, and some severe arthritics, would be extreme exceptions to 3.4.1 and 3.4.2.

5 Site development is the most effective means to resolve the problems created by topography, definitive architectural designs or concepts, water table, existing streets, and atypical problems singularly or collectively, so that ingress, ingress, and egress to buildings by physically disabled can be facilitated while preserving the desired design and effect of the architecture.

6 It is essential that the gradient of walks and driveways be less than that prescribed for ramps, since walks would be void of handrails and curbs and would be considerably longer and more vulnerable to the elements. Walks of near maximum grade and considerable length should have level areas at intervals for purposes of rest and safety. Walks or driveways should have a nonslip surface.

7 This specification does not require the elimination of curbs, which, particularly if they occur at regular intersections, are a distinct safety feature for all of the handicapped, particularly the blind. The preferred method of meeting the specification is to have the walk incline to the level of the street. However, at principal intersections, it is vitally important that the curb run parallel to the street, up to the point where the walk is inclined, at which point the curb would turn in and gradually meet the level of the walk at its highest point. A less preferred method would be to gradually bring the surface of the driveway or street to the level of the walk. The disadvantage of this method is that a blind person would not know when he has left the protection of a walk and entered the hazards of a street or driveway.

APPENDIX G

4.3.3 Parking spaces for individuals with physical disabilities when placed between two conventional diagonal or head-on parking spaces should be 12 feet wide.

4.3.4 Care in planning should be exercised so that individuals in wheelchairs and individuals using braces and crutches are not compelled to wheel or walk behind parked cars.

4.3.5 Consideration should be given the distribution of spaces for use by the disabled in accordance with the frequency and persistency of parking needs.

4.3.6 Walks shall be in conformity with 4.2.

5. Buildings

5.1 Ramps with Gradients. Where ramps with gradients are necessary or desired, they shall conform to the following specifications:

5.1.1 A ramp shall not have a slope greater than 1 foot rise in 12 feet, or 8.33 percent, or 4 degrees 50 minutes.

5.1.2 A ramp shall have handrails on at least one side, and preferably two sides, that are 32 inches in height, measured from the surface of the ramp, that are smooth, that extend 1 foot beyond the top and bottom of the ramp, and that otherwise conform with American Standard Safety Code for Floor and Wall Openings, Railings, and Toe Boards, A12-1932.

NOTE 1: Where codes specify handrails to be of heights other than 32 inches, it is recommended that two sets of handrails be installed to serve all people. Where major traffic is predominantly children, particularly physically disabled children, extra care should be exercised in the placement of handrails, in accordance with the nature of the facility and the age group or groups being serviced.

NOTE 2: Care should be taken that the extension of the handrail is not in itself a hazard. The extension may be made on the side of a continuing wall.

5.1.3 A ramp shall have a surface that is non-slip.

5.1.4 A ramp shall have a level platform at the top which is at least 5 feet by 5 feet, if a door swings out onto the platform or toward the ramp. This platform shall extend at least 1 foot beyond each side of the doorway.

5.1.5 A ramp shall have a level platform at least 3 feet deep and 5 feet wide, if the door does not swing onto the platform or toward the ramp. This platform shall extend at least 1 foot beyond each side of the doorway.

5.1.6 Each ramp shall have at least 6 feet of straight clearance at the bottom.

5.1.7 Ramps shall have level platforms at 30-foot intervals for purposes of rest and safety and shall have level platforms wherever they turn.

5.2 Entrances

5.2.1 At least one primary entrance to each building shall be usable by individuals in wheelchairs.

NOTE: Because entrances also serve as exits, some being particularly important in case of an emergency, and because the proximity of such exits to all parts of buildings and facilities, in accordance with their design and function, is essential (see 112 and 2000 through 2031 of American Standard Building Exits Code, A9.1-1953) it is preferable that all or most entrances (exits) should be accessible to, and usable by, individuals in wheelchairs and individuals with other forms of physical disability herein applicable.

5.2.2 At least one entrance usable by individuals in wheelchairs shall be on a level that would make the elevators accessible.

5.3 Doors and Doorways

5.3.1 Doors shall have a clear opening of no less than 32

inches when open and shall be operable by a single effort.

NOTE 1: Two-leaf doors are not usable by those with disabilities defined in 2.1, 2.2, and 2.5 unless they operate by a single effort, or unless one of the two leaves meets the requirement of 5.3.1.

NOTE 2: It is recommended that all doors have kick plates extending from the bottom of the door to at least 16 inches from the floor, or be made of a material and finish that would safely withstand the abuse they might receive from canes, crutches, wheelchair foot-platforms, or wheelchair wheels.

5.3.2 The floor on the inside and outside of each doorway shall be level for a distance of 5 feet from the door in the direction the door swings and shall extend 1 foot beyond each side of the door.

5.3.3 Sharp inclines and abrupt changes in level shall be avoided at doorsills. As much as possible, thresholds shall be flush with the floor.

NOTE 1: Care should be taken in the selection, placement, and setting of door closers so that they do not prevent the use of doors by the physically disabled. Time-delay door closers are recommended.

NOTE 2: Automatic doors that otherwise conform to 5.3.1, 5.3.2, and 5.3.3 are very satisfactory.

NOTE 3: These specifications apply both to exterior and interior doors and doorways.

5.4 Stairs. Stairs shall conform to American Standard A9.1-1953, with the following additional considerations:

5.4.1 Steps in stairs that might require use by those with disabilities defined in 2.2 and 2.5 or by the aged shall not have abrupt (square) nosing. (See Fig. 1.)

NOTE: Individuals with restrictions in the knee, ankle, or hip, with artificial legs, long leg braces, or comparable conditions cannot, without great difficulty and hazard, use steps with nosing as illustrated in Fig. 1a, but can safely and with minimum difficulty use steps with nosing as illustrated in Fig. 1b.

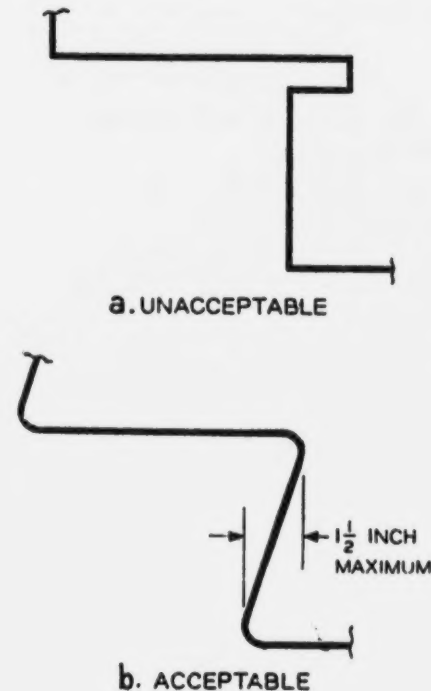


Fig. 1
Steps

5.4.2 Stairs shall have handrails 32 inches high as measured from the tread at the face of the riser.

NOTE: Where codes specify handrails to be at heights other than 32 inches, it is recommended that two sets of handrails be installed to serve all people. Where traffic is predominantly children, particularly physically disabled children, extra care should be exercised in the placement of handrails in accordance with the nature of the facility and the age group or groups being serviced. Dual handrails may be necessary.

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5.4.3 Stairs shall have at least one handrail that extends at least 18 inches beyond the top step and beyond the bottom step.

NOTE: Care should be taken that the extension of the handrails is not in itself a hazard. The extension may be made on the side of a continuing wall.

5.4.4 Steps should, wherever possible, and in conformance with existing step formulas, have risers that do not exceed 7 inches.

5.5 Floors

5.5.1 Floors shall have a surface that is nonslip.

5.5.2 Floors on a given story shall be of a common level throughout or be connected by a ramp in accord with 5.1.1 through 5.1.6, inclusive.

EXAMPLE 1: There shall not be a difference between the level of the floor of a corridor and the level of the floor of the toilet rooms.

EXAMPLE 2: There should not be a difference between the level of the floor of a corridor and the level of a meeting room, dining room, or any other room, unless proper ramps are provided.

5.6 Toilet Rooms. It is essential that an appropriate number of toilet rooms, in accordance with the nature and use of a specific building or facility, be made accessible to, and usable by, the physically handicapped.

5.6.1 Toilet rooms shall have space to allow traffic of individuals in wheelchairs, in accordance with 3.1, 3.2, and 3.3.

5.6.2 Toilet rooms shall have at least one toilet stall that—

- (1) Is 3 feet wide
- (2) Is at least 4 feet 8 inches, preferably 5 feet, deep
- (3) Has a door (where doors are used) that is 32 inches wide and swings out
- (4) Has handrails on each side, 33 inches high and parallel to the floor, 1 1/2 inches in outside diameter, with 1 1/2 inches clearance between rail and wall, and fastened securely at ends and center.
- (5) Has a water closet with the seat 20 inches from the floor.

NOTE: The design and mounting of the water closet is of considerable importance. A wall-mounted water closet with a narrow under-structure that recedes sharply is most desirable. If a floor-mounted water closet must be used, it should not have a front that is wide and perpendicular to the floor at the front of the seat. The bowl should be shallow at the front of the seat and turn backward more than downward to allow the individuals in a wheelchair to get close to the water closet with the seat of the wheelchair.

5.6.3 Toilet rooms shall have lavatories with narrow aprons, which when mounted at standard height are usable by individuals in wheelchairs; or shall have lavatories mounted higher, when particular designs demand, so that they are usable by individuals in wheelchairs.

NOTE: It is important that drain pipes and hot-water pipes under a lavatory be covered or insulated so that a wheelchair individual without sensation will not burn himself.

5.6.4 Some mirrors and shelves shall be provided above lavatories at a height as low as possible and no higher than 40 inches above the floor, measured from the top of the shelf and the bottom of the mirror.

5.6.5 Toilet rooms for men shall have wall-mounted urinals with the opening of the basin 19 inches from the floor, or shall have floor-mounted urinals that are on a level with the main floor of the toilet room.

5.6.6 Toilet rooms shall have an appropriate number of towel racks, towel dispensers, and other dispensers and disposal units mounted no higher than 40 inches from the floor.

5.7 Water Fountains. An appropriate number of water fountains or other water-dispensing means shall be accessible to, and usable by, the physically disabled.

5.7.1 Water fountains or coolers shall have up-front spouts and controls.

5.7.2 Water fountains or coolers shall be hand-operated or hand- and foot-operated. (See also American Standard Specifications for Drinking Fountains, Z4.2-1942.)

NOTE 1: Conventional floor-mounted water coolers can be serviceable to individuals in wheelchairs if a small fountain is mounted on the side of the cooler 30 inches above the floor.

NOTE 2: Wall-mounted, hand-operated coolers of the latest design, manufactured by many companies, can serve the able-bodied and the physically disabled equally well when the cooler is mounted with the basin 36 inches from the floor.

NOTE 3: Fully recessed water fountains are not recommended.

NOTE 4: Water fountains should not be set into an alcove unless the alcove is wider than a wheelchair. (See 3.1.)

5.8 Public Telephones. An appropriate number of public telephones should be made accessible to, and usable by, the physically disabled.

NOTE: The conventional public telephone booth is not usable by most physically disabled individuals. There are many ways in which public telephones can be made accessible and usable. It is recommended that architects and builders confer with the telephone company in the planning of the building or facility.

5.8.1 Such telephones should be placed so that the dial and the handset can be reached by individuals in wheelchairs, in accordance with 3.3.

5.8.2 An appropriate number of public telephones should be equipped for those with hearing disabilities and so identified with instructions for use.

NOTE: Such telephones can be used by everyone.

5.9 Elevators. In a multiple-story building, elevators are essential to the successful functioning of physically disabled individuals. They shall conform to the following requirements:

5.9.1 Elevators shall be accessible to, and usable by, the physically disabled on the level that they use to enter the building, and at all levels normally used by the general public.

5.9.2 Elevators shall allow for traffic by wheelchairs, in accordance with 3.1, 3.2, 3.3 and 5.3.

5.10 Controls. Switches and controls for light, heat, ventilation, windows, draperies, fire alarms, and all similar controls of frequent or essential use, shall be placed within the reach of individuals in wheelchairs. (See 3.3.)

5.11 Identification. Appropriate identification of specific facilities within a building used by the public is particularly essential to the blind.

5.11.1 Raised letters or numbers shall be used to identify rooms or offices.

5.11.2 Such identification should be placed on the wall, to the right or left of the door, at a height between 4 feet 6 inches and 5 feet 6 inches, measured from the floor, and preferably at 5 feet.

5.11.3 Doors that are not intended for normal use, and that might prove dangerous if a blind person were to exit or enter by them, should be made quickly identifiable to the touch by knurling on the door handle or knob. (See Fig. 2.)

NOTE: Knurling can be imposed upon door handles or knobs by use of textured plastic.

EXAMPLE: Such doors might lead to loading platforms, boiler rooms, stages, fire escapes, etc.

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5.12 Warning Signals

5.12.1 Audible warning signals shall be accompanied by simultaneous visual signals for the benefit of those with hearing disabilities.

5.12.2 Visual signals shall be accompanied by simultaneous audible signals for the benefit of the blind.

5.13 Hazards. Every effort shall be exercised to obviate hazards to individuals with physical disabilities.

5.13.1 Access panels or manholes in floors, walks, and walls can be extremely hazardous, particularly when in use, and should be avoided.

5.13.2 When manholes or access panels are open and in use, or when an open excavation exists on a site, particularly when it is approximate to normal pedestrian traffic, barricades shall be placed on all open sides, at least 8 feet

from the hazard, and warning devices shall be installed in accord with 5.12.2.

5.13.3 Low-hanging door closers that remain within the opening of a doorway when the door is open, or that protrude hazardously into regular corridors or traffic ways when the door is closed, shall be avoided.

5.13.4 Low-hanging signs, ceiling lights, and similar objects or signs and fixtures that protrude into regular corridors or traffic ways shall be avoided. A minimum height of 7 feet, measured from the floor, is recommended.

5.13.5 Lighting on ramps shall be in accord with 1201, 1202, 1203, and 1204 of American Standard A9.1-1953.

5.13.6 Exit signs shall be in accord with 1205 of American Standard A9.1-1953, except as modified by 5.11 of this standard.

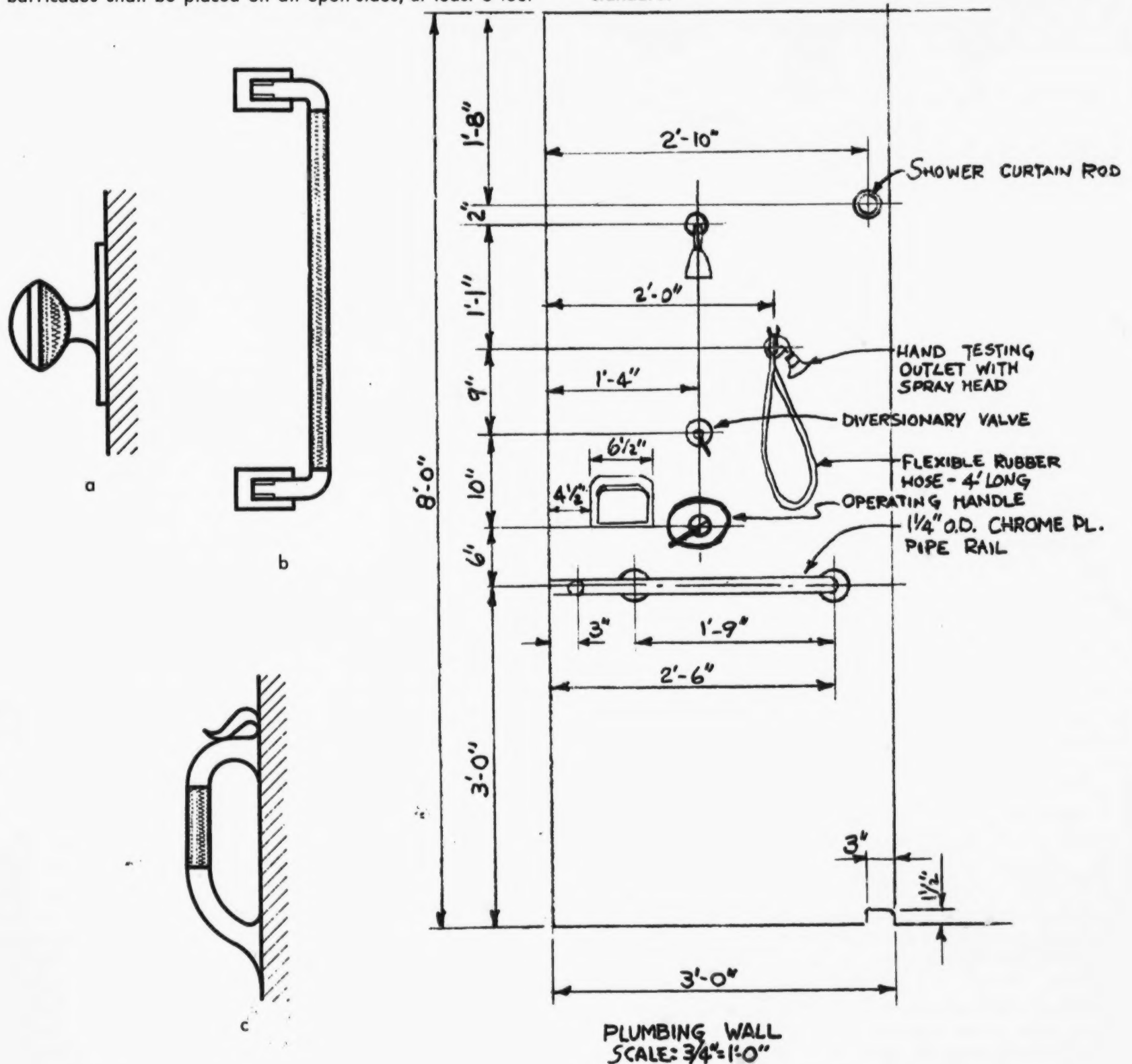
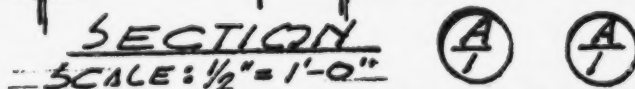
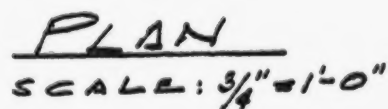


Fig. 2

Knurled Door Handles and Knobs

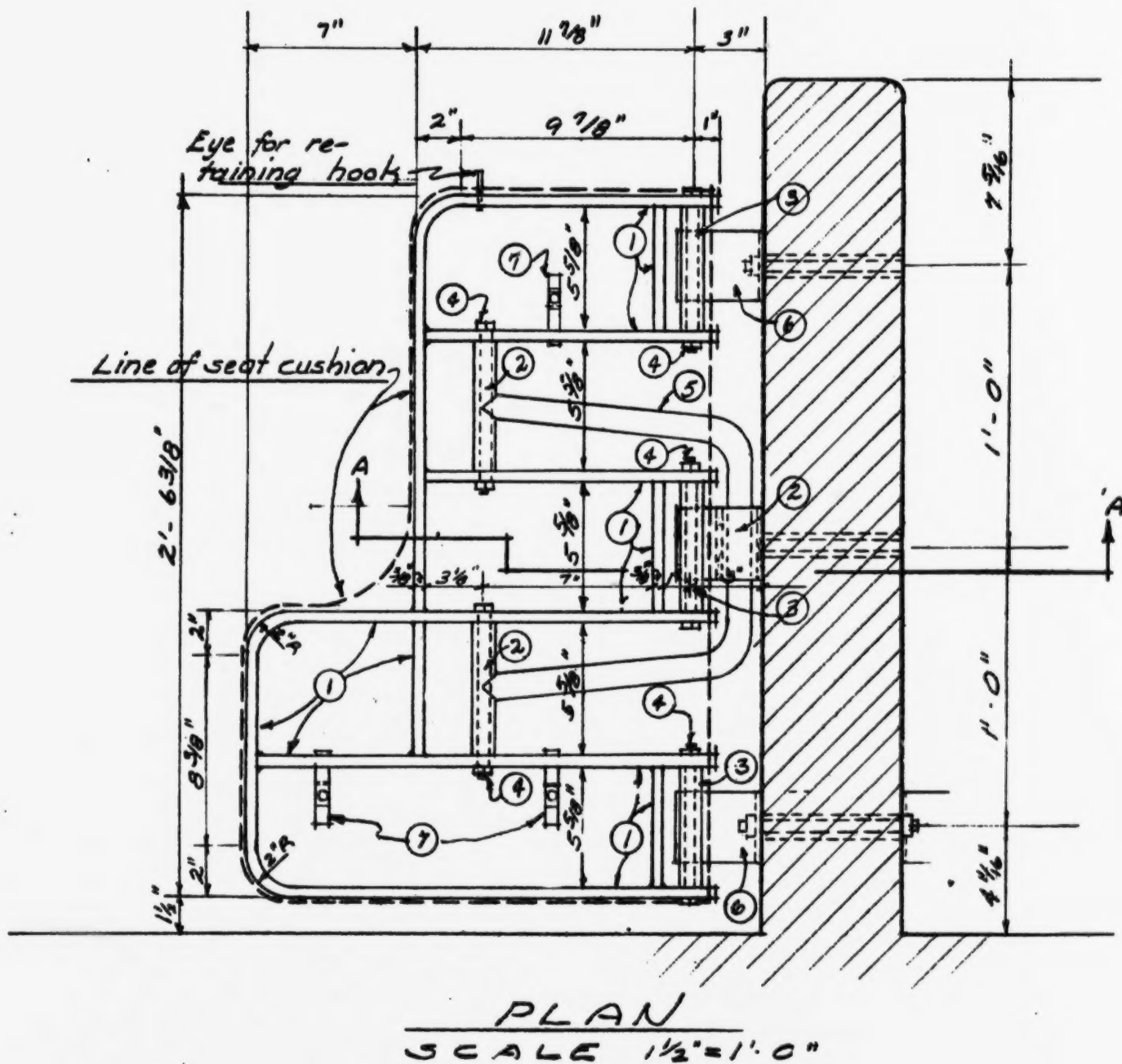
SHOWER FACILITIES

RECOMMENDED FACILITY ADAPTATIONS FOR THE AGING AND THE DISABLED



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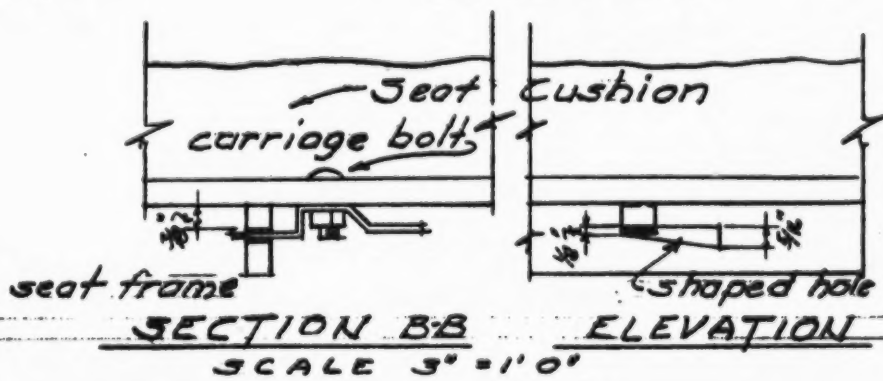
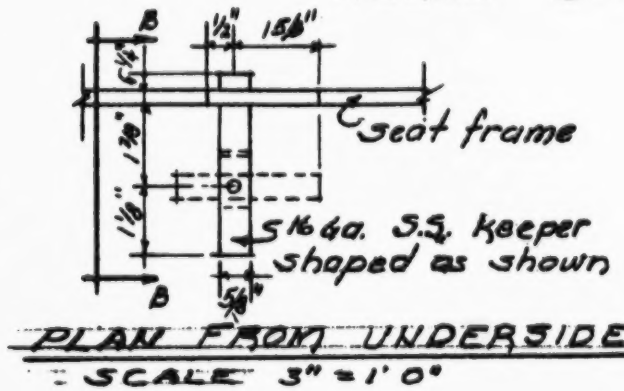
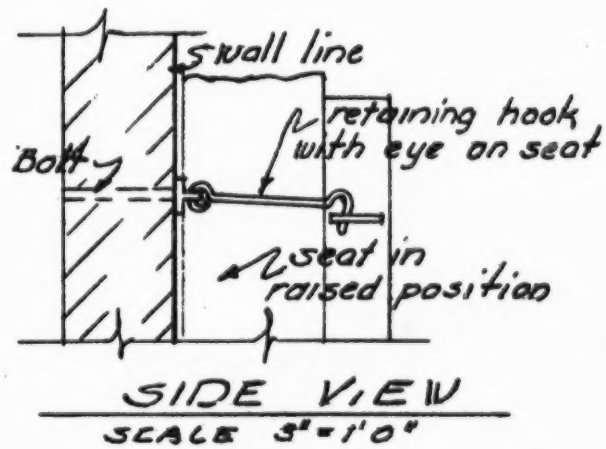
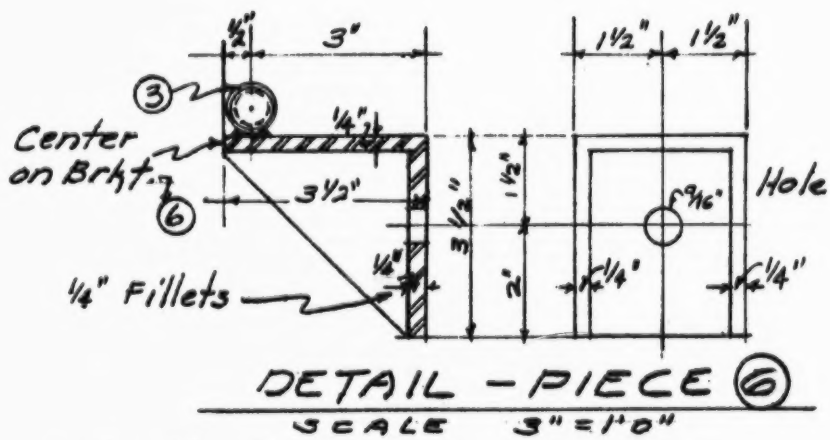
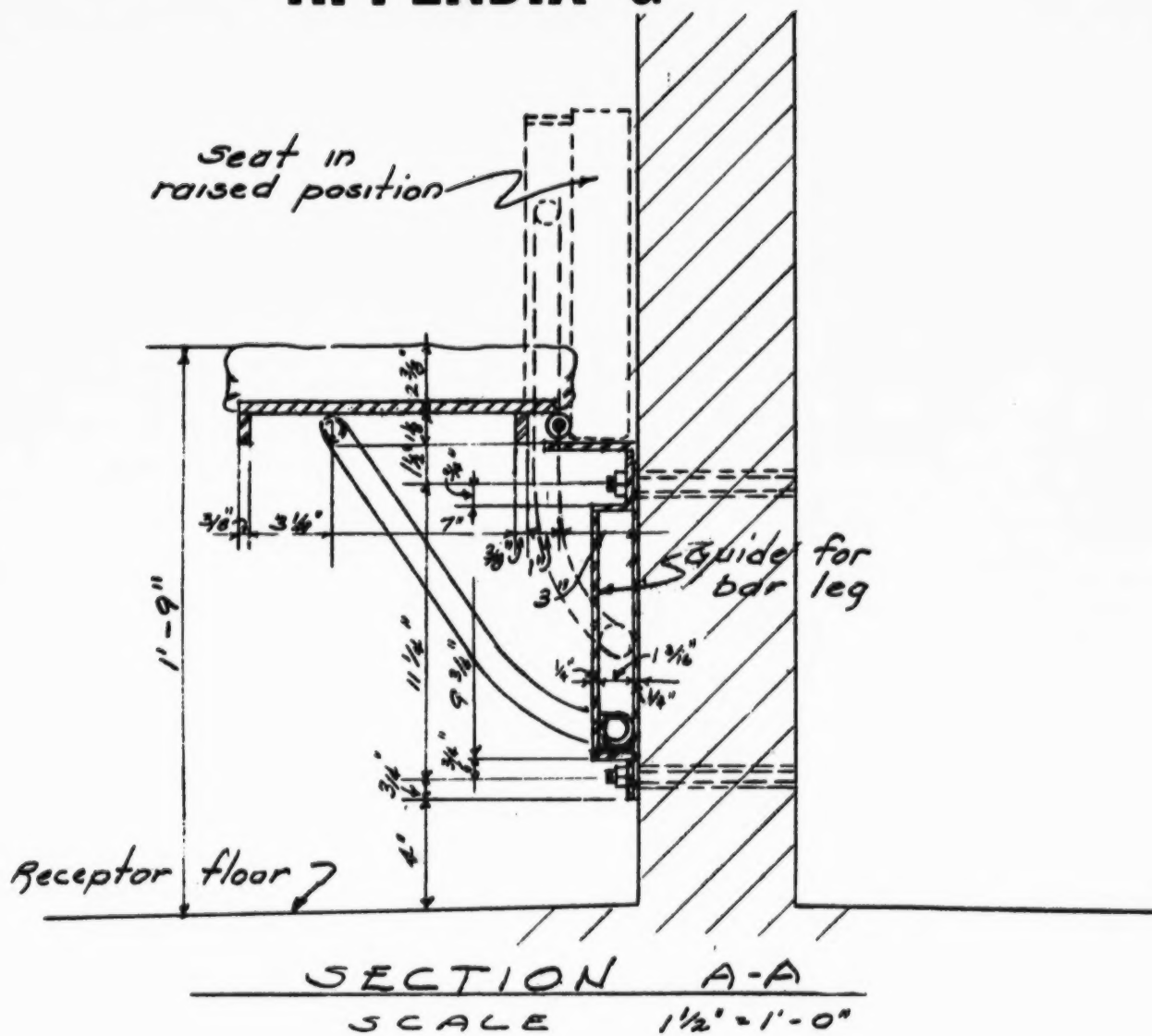


KEY

- ① - $\frac{3}{8}$ " x $1\frac{1}{4}$ " Flat bar aluminum alloy - shape shown
- ② - Seat bracket & guide - S.S. - see detail.
- ③ - 1" O.D. tubing - .203" thick - S.S. - Allow clearance. Weld to ⑥
- ④ - $\frac{1}{2}$ " ϕ Bolts - S.S. - 8" long - last $1\frac{1}{8}$ " threaded.
- ⑤ 1" O.D. ϕ Bar - S.S. Shape shown.
- ⑥ - Seat brackets - 2 per seat S.S.
- ⑦ Keeper - see Detail

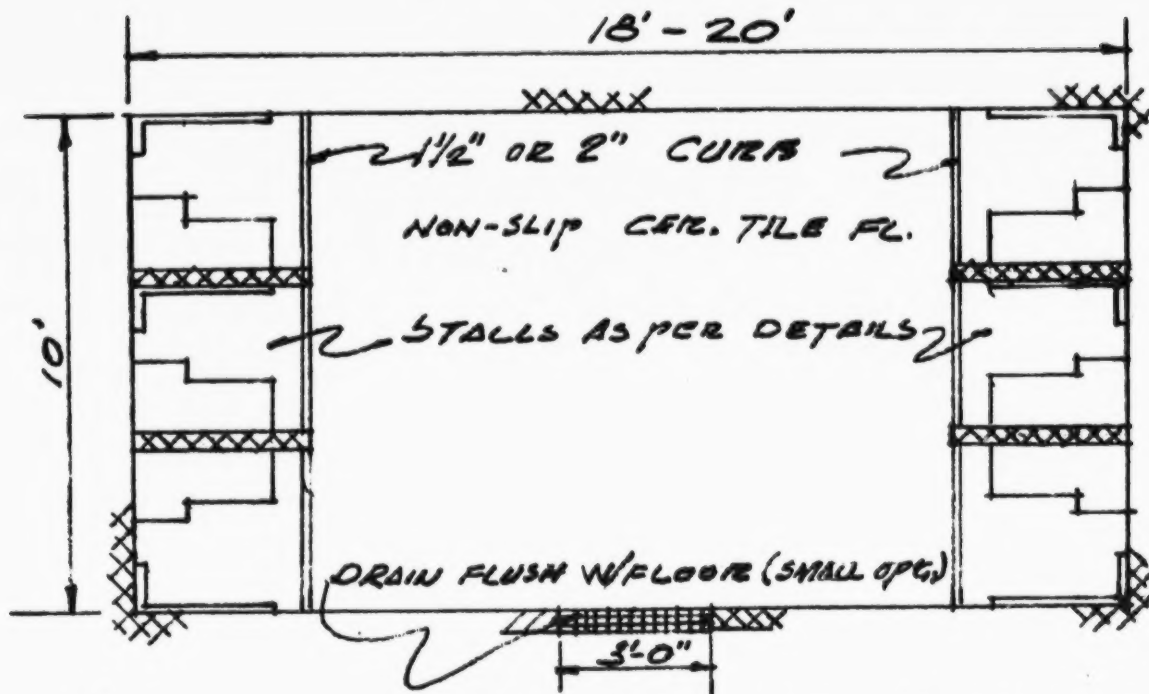
FOLDING SHOIVER SEATS
FOR PARAPLEGIC SHOIVERS

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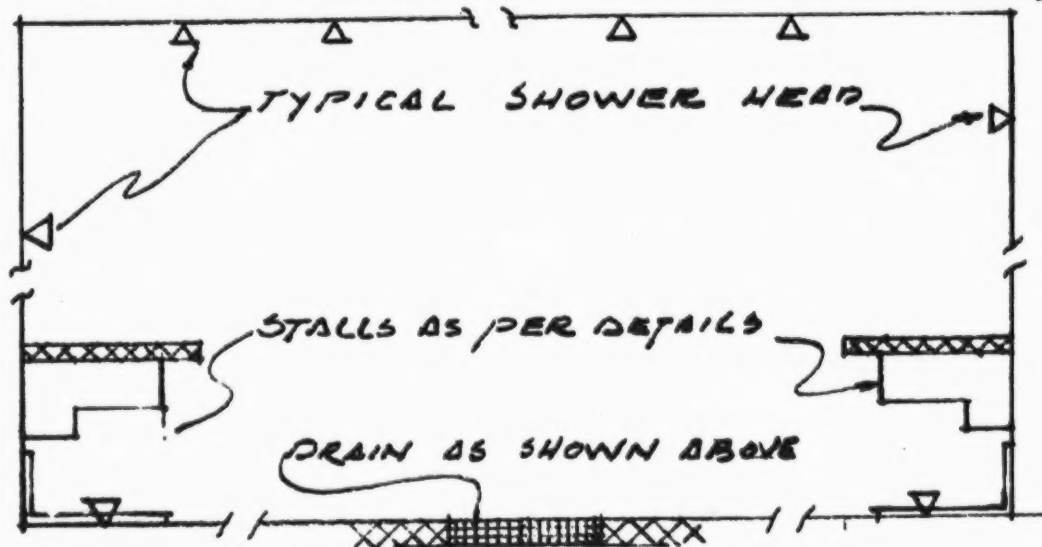


FOLDING SHOWER SEATS FOR PARAPLEGIC SHOWERS

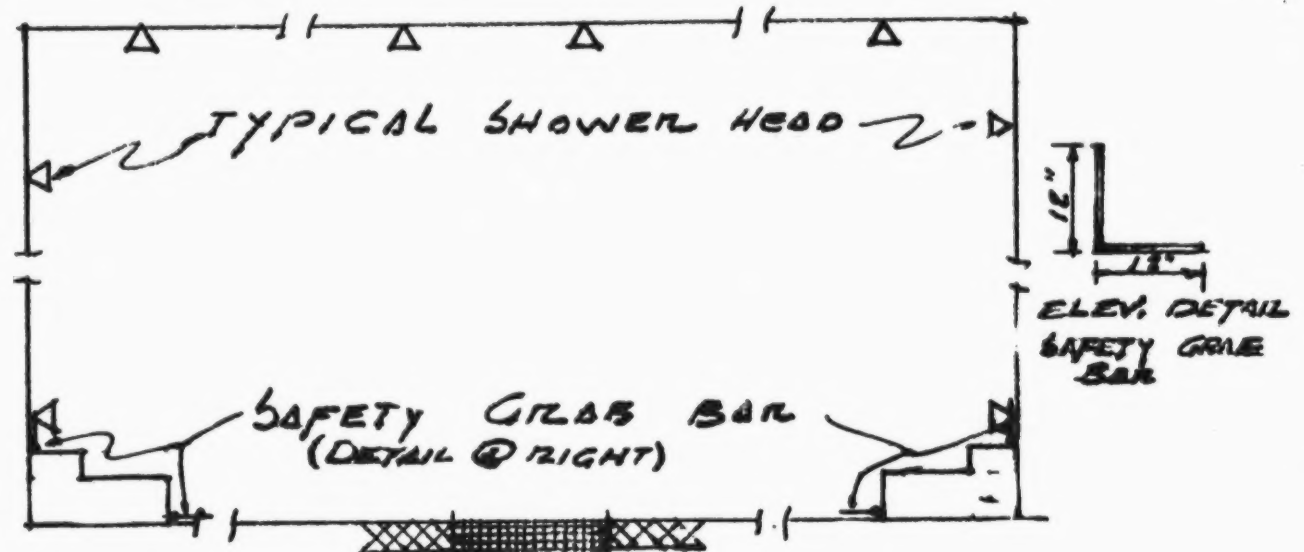
APPENDIX G



STALL-GANG SHOWER (MOST DESIRABLE FOR LARGE NUMBER OF DISABLED OR AGED)

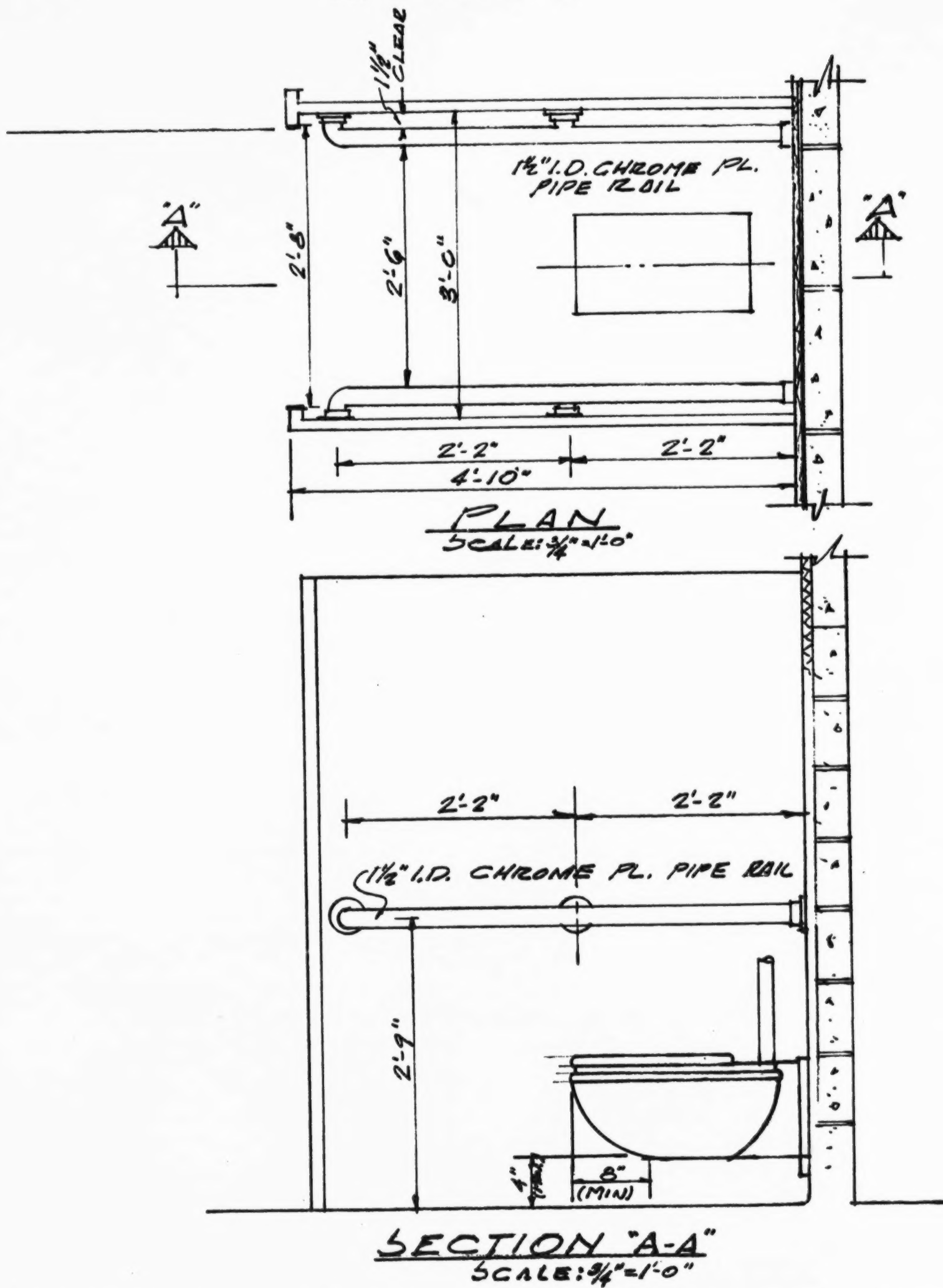


STALL SHOWER AS PART OF GANG SHOWER (DESIRABLE FOR MULTI-USE; LIMITED NO. OF AGED & DISABLED)



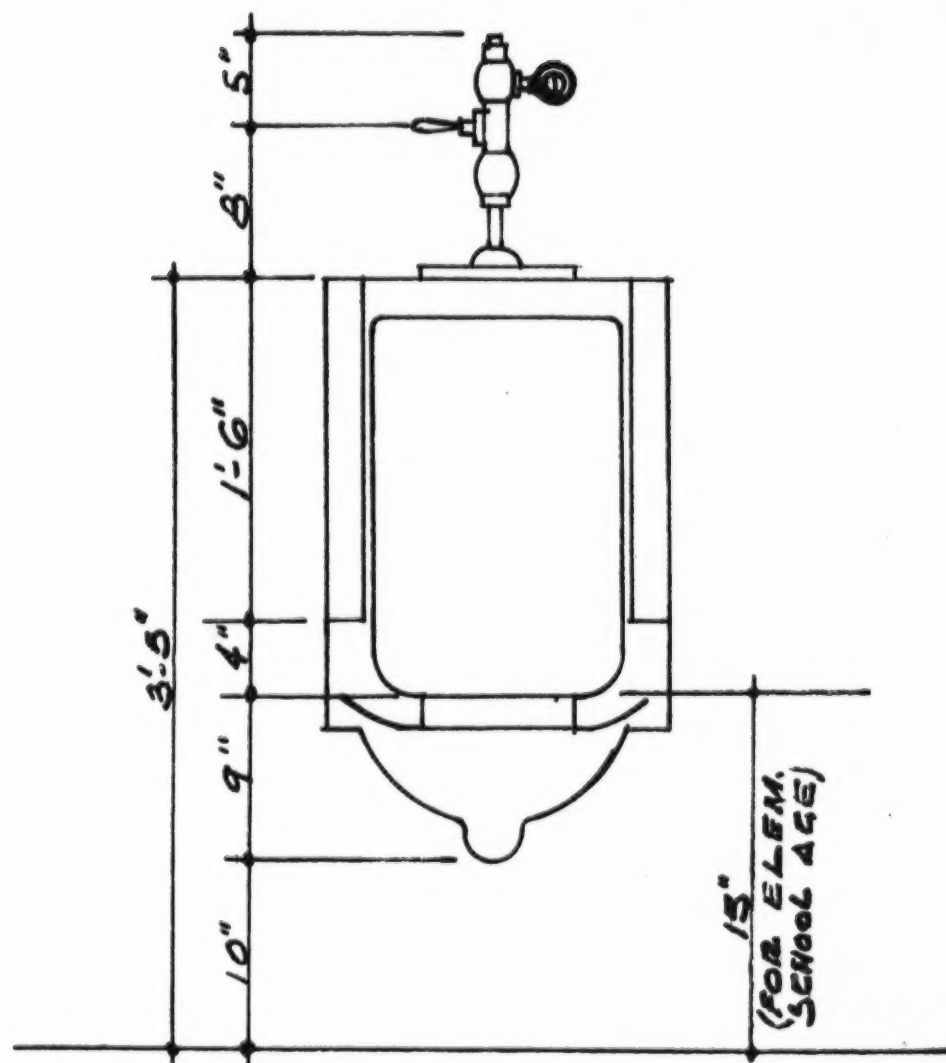
SEAT IN GANG SHOWER (LEAST DESIRABLE)

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STANDARD PARAPLEGIC TOILET STALL

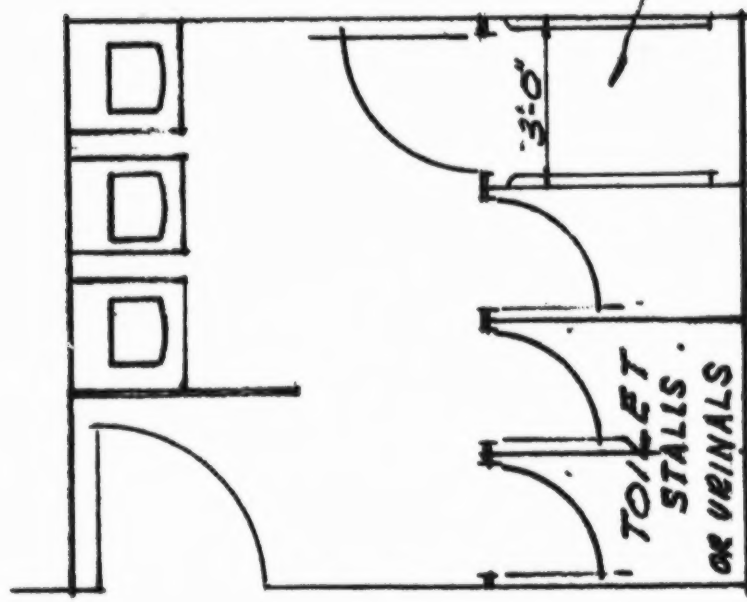
APPENDIX G



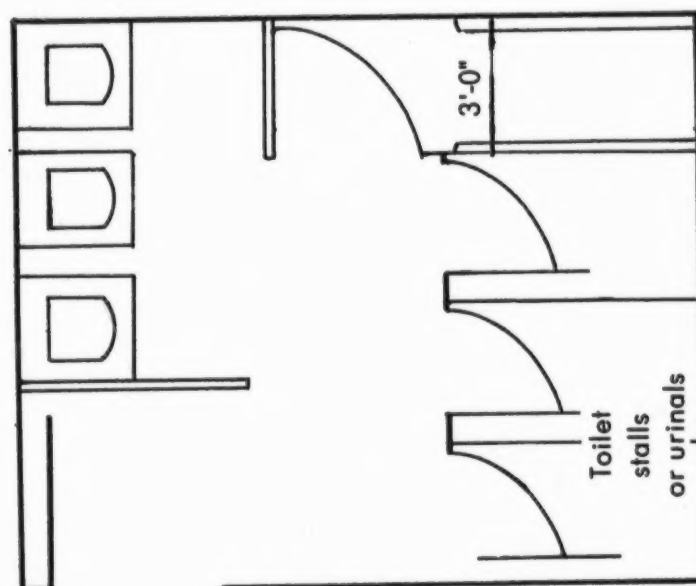
WALL MOUNTED URINAL
SCALE: 1" = 1'-0"

APPENDIX G

FOR DISABLED - FARTHEST
FROM ENTRANCE WITH DOOR
HINGED AT WALL SIDE.



"MINIMUM"

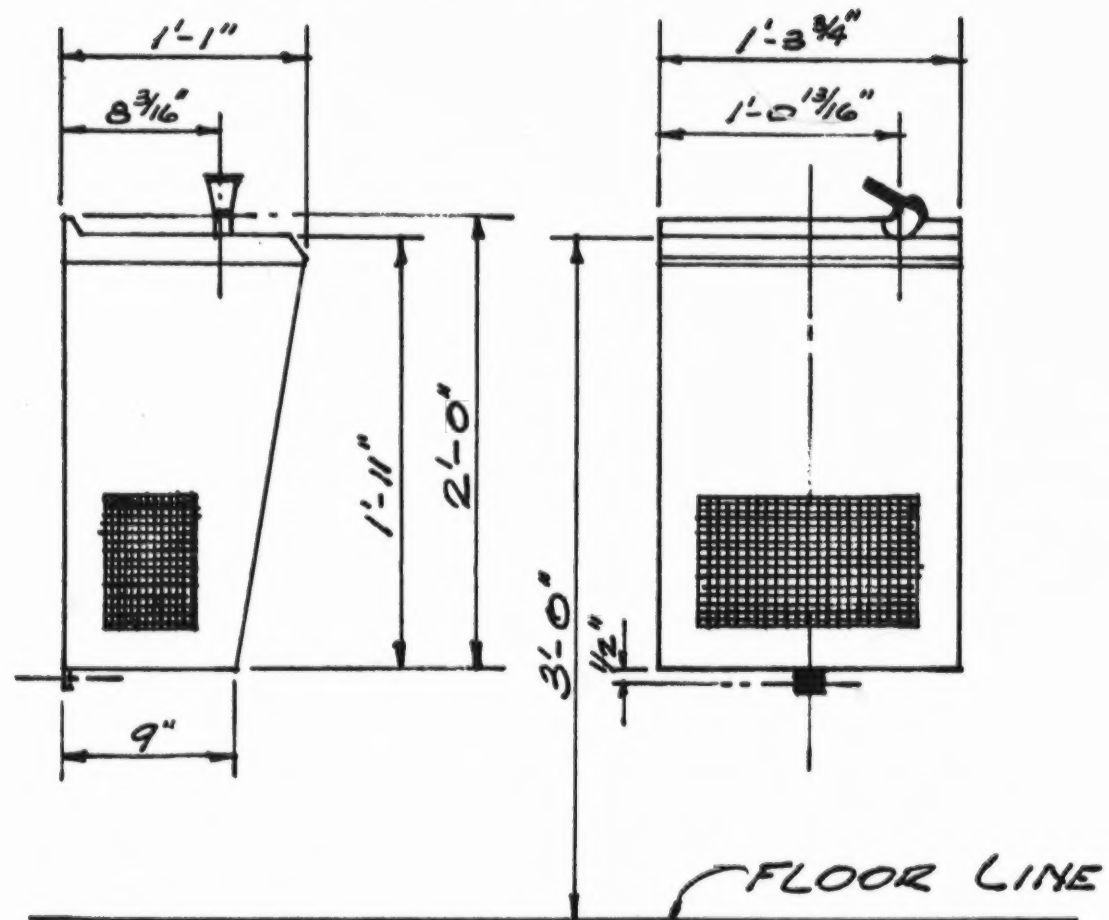


"PREFERRED"

SUGGESTED PLACEMENT OF WIDE STALL
WITH OUTSWINGING DOOR IN TOILET ROOM

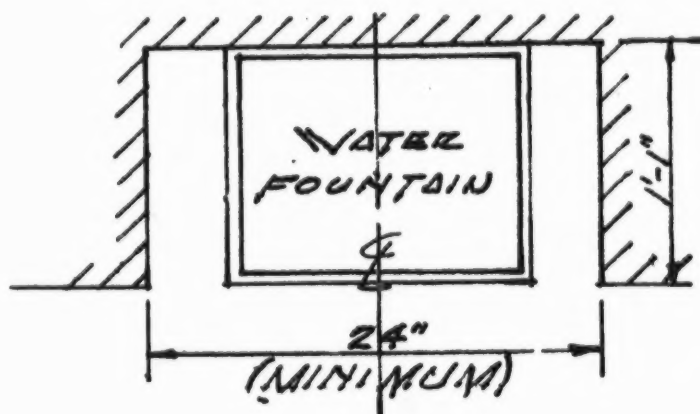
NOT TO SCALE

APPENDIX G

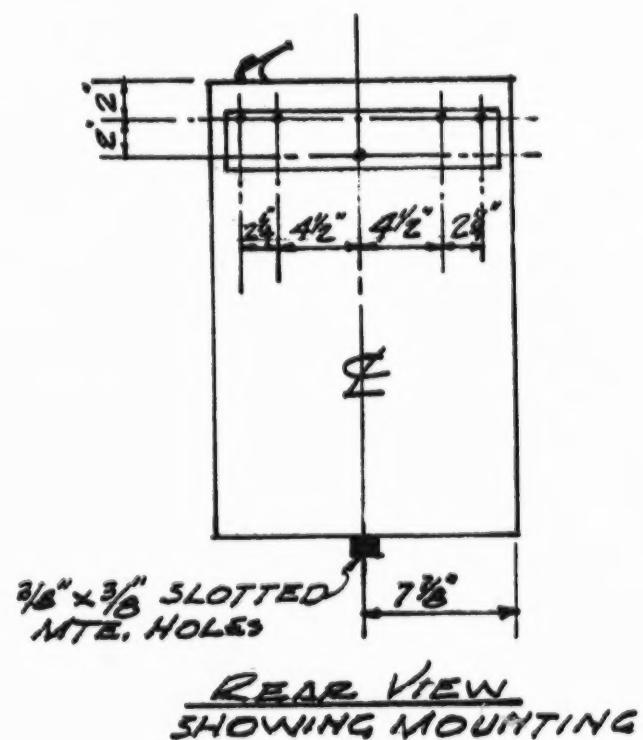


SIDE ELEVATION

FRONT ELEVATION



If recess is necessary
or desired, it must have
this minimum characteristic.

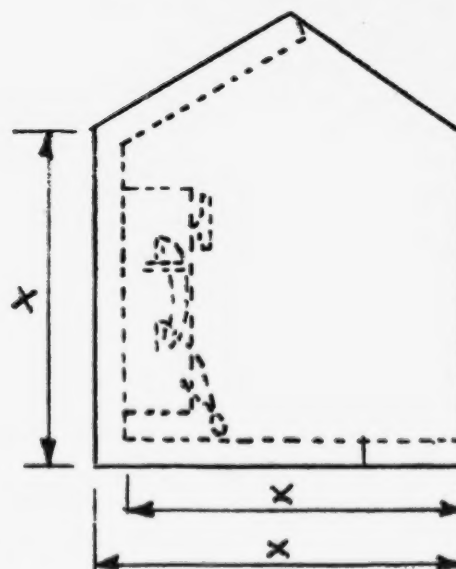
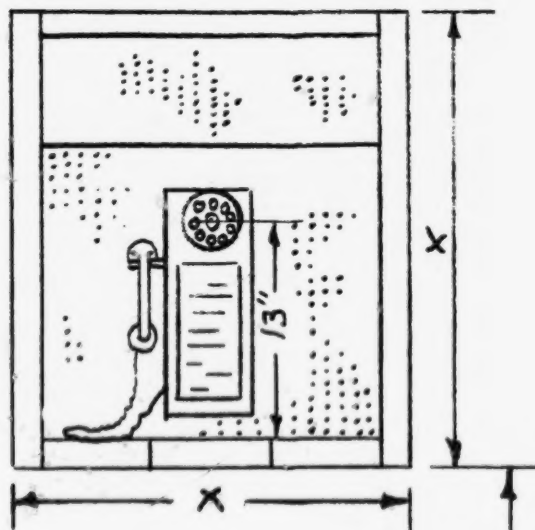
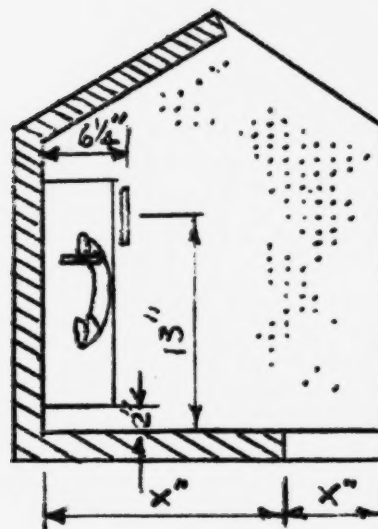
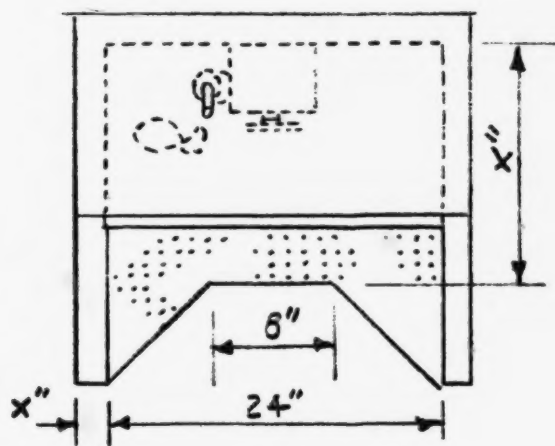


REAR VIEW
SHOWING MOUNTING

PLAN

WATER FOUNTAIN-RECESSED IN WALL
SCALE: 1"=1'-0"

APPENDIX G



HEIGHT
FROM FLOOR 34"-36"

FLOOR LINE ↗

WALL MOUNTED PREFERRED.
IF FLOOR MOUNTED, PLACE
LESS - IN ACCORDANCE WITH
A.S.A.-A117.1-1961

PLAN OF PLACEMENT OF MODERN TELEPHONES

(SEVERAL DESIGNS AVAILABLE)

SCALE $\frac{3}{4}" = 1'-0"$

TO BE EQUALLY USABLE BY ABLE &
DISABLED & SMALLER CHILDREN

APPENDIX H

ABBREVIATED CHECK LIST FOR FACILITY PLANNING

It is hoped that this **Check List** will give some additional direction in securing and planning the necessary facilities. Selected standards, items for convenience, and special features are also listed so that the facilities can be utilized most effectively.

GENERAL

- Written program essential. All requirements of facility spelled out in detail. All staff members contribute. Function, size, and relationship important.
- Ad Hoc Building Committee which includes representatives from Health, Physical Education, and Recreation faculty and staff, and general administration.
- Visitation to similar facilities of other colleges/universities most profitable. Cost of travel saved many times by avoiding mistakes and gaining ideas.
- Future as well as present needs estimated and firm policies established with appropriate parties.
- Gross construction and equipment budget established.
- Budget contingencies of not less than 10 percent.
- All staff and specialists review preliminary and final working drawings so as to incorporate experience into the final plans.
- Tare space (toilets, circulation, mechanical structure) within 20 to 25 percent of gross area.
- Plans meet all building codes.
- Facilities vandalproof, easy to maintain, and, most important, functional.
- Building carefully related to site. Adequate parking and circulation. Coordinated with master plan.
- Certain consultants, such as acoustical engineer, utilized to insure proper design of specialized areas.
- Consideration given to future expansion plans.
- Special needs of physically handicapped met (ramps and other conveniences).
- Circulation spaces allow for movement of crowds and oversized equipment.
- Elevator(s) and/or dumb waiter for movement of equipment.
- Keying planned jointly by the HPER administrator, university building and grounds personnel, and hardware supplier. Hardware schedule door numbers and architect's door numbers are identical.
- Adequate allowances for space, and number and types of teaching stations. (See specific chapters for standards.)
- Teaching stations planned for multiple use where advisable.
- Adequate outlets throughout, both 110v and 220v.
- Clocks in all classrooms (at rear), public places, and offices.
- Spotlights for archery and rifle targets.
- Telephone and intercom to all offices.
- Provision for easy relamping of all light fixtures.
- Sprinklers in combustible storage area.
- Oversize drains in necessary areas such as hydrotherapy and laundry.
- Easy access to plumbing chase and piping.
- Adequate water supply and drain for pool.
- Thermostatic control and pressure regulators in all shower plumbing.
- Self-cleansing shower heads.
- Adequate number of drinking fountains.
- Ducts designed for future air-conditioning if not provided.
- Separate thermostats in areas.
- One hundred percent exhaust for steamy or odor-producing spaces, such as locker, shower, toilet, and animal rooms.
- Special attention to mechanical ventilation for pools, handball courts, and other critical areas.
- Emergency lighting equipment.

STRUCTURE AND FINISHES

- In control of partial use of buildings, entire building does not have to be unlocked when only one or two areas are being used.
- Hazards such as low door closers, projections, and rough walls eliminated.
- When needed, movable roll-away bleachers used.
- Trophy cases, public telephones, and ticket booths provided.
- Color schedule reviewed by building occupants.
- Overhead-supported apparatus and catwalks secured to beams engineered to withstand loads.
- In most instances, movable and folding partitions power-operated and controlled by keyed switches.
- Proper inserts for equipment such as net standards. Goals and apparatus securely recessed in walls and floors according to court locations and functional needs.
- Matting or other appropriate materials provided on walls where needed, such as under basketball goals and in wrestling rooms.
- In large teaching-station areas, walls are stable and usable for rebounding purposes such as tennis practice. Ease of maintenance.
- Floor design and materials conform to latest standards and specifications.
- Line markings completed before final seal coat is applied.
- Abrasive, nonskid, slip-resistant flooring impervious to water in all areas where water and moisture are prevalent, such as laundry, swimming-pool, shower, dressing, drying, and animal-experimentation rooms.

INDOOR ACTIVITY AREAS

GENERAL-USE GYMNASIUM(S)

- Contains at least 25,000 square feet.
- Ceiling height minimum of 24 feet.
- Adequate storage areas with double doors.

MECHANICAL SERVICES

(Electrical, Heating-Ventilation, Plumbing)

- Shielded, vaporproof light fixtures in moisture-prevalent area.
- Electrical switches and outlets kept out of wet areas and four feet off floor.
- Lighting standards met (see Chapter 4).
- Lighting in large areas wired in zones, suitably rheostated for economy of operation.
- Special protection for lights where needed.
- Fire-alarm systems as per code.
- Main electrical feed lines allow for growth (light level—additional equipment).

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- Electrical outlets and jacks for public-address system, scoreboards, TV and other uses strategically located.
- Wall free of obstructions. Hard, easily-cleaned surface for ball-rebounding activities.
- Adequate seating selected for multiple use of facility. Best utilization of space.
- Safety zones provided between courts, and between boundary lines and walls.

GYMNASTICS GYMNASIUM(S)

- Minimum of 10,000 square feet. Ceiling height minimum of 24 feet.
- Proper inserts and rigging for apparatus.
- Adequate storage—minimum of 600 square feet—for contemplated equipment.
- Multiple-use and zoned areas coordinated.

WRESTLING AND PERSONAL-DEFENSE ROOM(S)

- Walls, doors, and floors padded and free from projections. Doors swing outward or are cut to swing inward over matted areas.
- Adequate space or provisions made for nonparticipants to enter area.
- Shrinkage has been figured in specifications for mats.
- When necessary, mats are movable.
- Other possible uses, such as tumbling instruction.

WEIGHT-EXERCISE ROOM(S)

- Contains at least 2,500 square feet, with ceiling at least 12 feet high.
- Adequate provision for moving heavy equipment, and for storage and anchoring of equipment.
- Floors constructed to withstand and/or protected against use of heavy equipment.
- Full-length mirrors placed 24 inches from floor.
- Adequate mechanical services and acoustical treatment provided.

HANDBALL AND SQUASH COURTS

- Minimum of eight courts of regulation size for either handball or squash, or both. Where budget dictates, courts are used interchangeably with contrasting court line markings and use of portable tell-tales.
- All fixtures, hardware, and obstructions placed flush and in areas that conflict the least with play.
- Special attention given to mechanical-service specifications that insure proper ventilation, control of moisture, and adequate lighting.
- New construction design and materials studied and used where feasible.
- Space and construction design provided in rear of courts allow for instructional and possible spectator opportunities.

EXERCISE-THERAPY ROOM(S)

- Located at ground level with easy access, or other provisions are made (such as ramps or elevators).
- Designed for privacy.
- Walls, floors, and ceiling support special equipment.
- Adequate storage space available.
- Multipurpose possibilities as other teaching station.

BOWLING LANE(S)

- Special attention to mechanical services, acoustical con-

trol, and lighting.

- Sufficient space for storage, spectator area, and concession areas.
- Intercommunication-and-amplifying system..
- Adequate passages and doors for movement of large equipment.

RIFLE RANGE(S)

- Safety precautions are essential, such as placement of entrances, sufficient space between each firing point, and protection against ricocheting bullets.
- Backstop and steel plate of the backstop are of sufficient thickness and at proper angle.
- Ample firing stations to accommodate a class of 20 students.

FENCING ROOM(S)

- Multipurpose area with sufficient size to provide official-length strips for both instructional and intercollegiate programs.
- Floors lined with regulation fencing strips.
- Fencers can work with electrical equipment.
- Fencing targets are attached to wall.

INDOOR ARCHERY RANGE(S)

- Sufficient storage available for targets and equipment.
- Room specifications are sufficient for practice on regulation range without hitting fixtures and ceiling.
- Entrances to range are behind shooting line or adequately controlled to prevent persons moving into line-of-flight of arrows.
- Mounted targets on easily-movable frames facilitate use of area for other activities.

DANCE STUDIO(S)

- Minimum of 100 square feet per student at peak load.
- Full-length mirrors on one or more walls (30 feet), placed 24 inches above floor level.
- Adequate dispersal of microphone jacks, electrical outlets, and speaker installations.
- Ample built-in cabinets for record players, microphones, and amplifiers.
- Ballet barres (adjustable heights from 40 to 48 inches) on one or more walls.
- Located near dressing rooms and outside entrance.
- Wooden, resilient floor, without wax or resin finish, for proper slide and protection of bare feet.
- Ceiling height proportional to size of studio (12-foot minimum).
- Acoustically treated.
- Large studio with a step rise in floor level has advantages, such as two teaching stations and modified stage.
- Traffic patterns and spectator space considered when performing stage is included in studio area.
- Lighting for stage area includes special wiring and fixtures, such as dimmer board, battens with fresnel, follow spots, and floor pockets.
- Ample storage areas (percussion and music cabinets, and space for costumes and stage properties).
- Aesthetic considerations are included (carefully-selected colors and draperies).
- Auxiliary areas, or other combination exercise areas, are planned for classes and recreational groups in the social forms of dance. Mechanical and acoustical services are important.

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SWIMMING POOLS

- Clear-cut statement on specific programs and requirements for facilities, in addition to general principles.
- Board of Health and other code regulations met.
- Latest knowledge and experience incorporated in planning. Experienced pool consultant, architect, or engineer has advised on design and equipment.
- Proper depths to accommodate age groups and types of activities.
- Minimal depth for diving: 10 feet for 1-meter boards, 12 feet for 3-meter boards, and 16 feet for 10-meter towers.
- Requirements met for competitive swimming, such as 7-foot indoor lanes (eight-foot outdoors), and 12-inch black or brown lines on the pool bottom; pool 1 inch longer than official measurement; depth and distance markings.
- Adequate deck space for instructional needs.
- Adequate office space with entire view of pool area and toilet-shower-dressing area.
- Recessed steps or removable ladders do not interfere with competitive-swimming turns.
- Properly-constructed overflow gutter extends around pool perimeter.
- Adequate storage spaces for maintenance and instructional equipment.
- Spectator space separated from pool area. Proper sight lines.
- All equipment, such as diving equipment and lane anchors, securely and safely anchored.
- Traffic patterns give efficient control of swimmers from showers and locker rooms to pool, and toilet facilities provided for wet swimmers are separate from the dry area.
- Recirculation pump located below the water level.
- Access to filter room allows for ease in maintenance and movement of materials.
- Proper drainage in pool, on pool deck, in overflow gutter, and on floors of shower, drying, and dressing rooms.
- Adequate space allowed around and below diving boards. Fifteen feet clearance above 1- and 3-meter boards, and 10 feet above 10-meter platform.
- Effective circulation of water in pool, with adequate inlets and outlets.
- Underwater lights, underwater observation windows, and underwater speakers of proper design and installation.
- Temperatures maintained: air 2° to 4° higher than water temperature; water temperature for general use is 78° to 82°; temperature of 68° for competitive swimming; and humidity of 45 to 55 percent.
- Gutter waste water and direct waste water valved to return to the filters.
- Mechanical services, acoustical treatment, and nonglare lighting have received special attention.
- All metal fittings are of noncorrosive material.
- Provision for servicing and maintaining pipes, lighting, machinery, and equipment.

SERVICE AREAS

LOCKER, SHOWER, AND DRYING ROOMS

- Functional locker rooms serve both indoor and outdoor teaching stations. Traffic patterns avoid crossing corridors.
- Size, type, and mechanical services of locker rooms based on projected growth and needs.

- Materials used in construction of service areas planned for ease in cleaning (such as coved bases) and resistance to moisture (such as noncorrosive metals and impervious materials).
- Floor surfaces nonslip and pitched toward drains.
- Opaque windows installed where feasible, and placed properly for privacy.
- Layout of locker room provides ease in supervision.
- Foot traffic kept to minimum, with dry-aisle traffic patterns.
- Vaporproof lighting fixtures, and safe location of electrical outlets and switches.
- Special drains with mud crocks located at entrances from the playing fields, with provisions for hosing down.
- Separate locker and shower facilities for swimming.
- Gang (group) showers, but approximately 10 percent individual shower-dressing stalls in women's areas.
- Towel bars, or hooks, and foot-drying ledge in towelng areas.
- Toilet floors kept clear of partitions and fixtures.
- Locker and shower facilities for faculty.
- Provision for use of dressing-shower facilities by officials.
- Adequate dressing space between lockers in both men's and women's locker rooms.
- Mirrors not placed above lavatories, and adequate hair dryers.
- Adequate drinking fountains.
- Careful selection of locker system based upon specific needs.
- Temperature control and adequate hot water essential.
- Adequate ventilation of lockers and locker rooms most important.

FIRST-AID AND ATHLETIC-TRAINING ROOMS

- Adequate training room(s) convenient to locker room.
- Hydrotherapy, electrotherapy, taping, and exercise areas functionally zoned in suite. Wet areas curbed, with adequate drains.
- Adequate mechanical services for all equipment.
- Room specifications similar to those for shower and drying rooms.
- Athletic trainer (physical therapist) is key person in functional planning.
- First-aid rooms convenient to spectator facilities.

MISCELLANEOUS

- Laundry room(s) sized for projected needs. Laundry installation specifications built in.
- Matron and custodial spaces with maintenance facilities.
- Adequate storage space (minimum of 300 square feet for each area). Adjoining teaching stations with double doors.
- Central check-out and repair space adequate for equipment and supplies (see Chapter 9).
- Proper security for storage and equipment areas.

CLASSROOMS, LABORATORIES, AND RELATED INSTRUCTIONAL AREAS

- Determine number of classrooms from curriculum and anticipated class enrollments.
- Emphasis on lecture-laboratory classes and inclement-weather transfers from outdoor areas require excess classroom capacity.
- Consider a 150- to 300-seat lecture hall with ramped seating.
- Space requirements range from 12 to 20 square feet per student (the larger the classroom capacity, the lower the

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allowance per student). For specialized instruction which requires storage and equipment, allow 20 to 35 percent additional space.

- In all classrooms, provide chalkboards, tackboards, and TV conduits, and make ample provisions for electrical outlets and for audiovisual aids.
- Careful attention to acoustics, color, and lighting (see Chapter 4).
- Student and faculty lounges include efficiency kitchenettes.
- Teaching materials centers have design criteria similar to libraries.
- Provide for student reading rooms. May possibly be combined with student lounge.
- When canteens are included, provide for adequate installation, servicing, and maintenance of space, with due regard to sanitary conditions.

OFFICES AND ADMINISTRATIVE UNITS

- Enough offices for future growth.
- Single offices provided for faculty and staff (see Chapter 12).
- Pleasant working conditions with good acoustics, privacy, and freedom from noise.
- Telephone and intercommunication system.
- Offices arranged to accommodate furnishings and traffic flow.
- Built-in safe or walk-in vault for records and/or tickets.
- Adequate provisions for offices for graduate assistants and for student activity offices.
- Workroom and storage spaces for secretaries (150 to 300 square feet minimum).
- Chalkboards and tackboards in appropriate offices.
- Well-arranged facilities for receiving and distributing mail.
- Efficient interrelationships of office facilities consistent with administrative organization.
- Adequate electrical outlets, lighting, and air-conditioning.
- Conference rooms may combine an efficiency kitchenette with units for reading and relaxation.
- Administrative suites located near main entrance.

RESEARCH AND TEACHING LABORATORIES

- Teaching and research laboratories available, including individual and possibly mobile laboratories.
- Sharing of service facilities, such as the data-processing area, workshop area, photographic darkroom, graphics area, and duplicating facility.
- Specific laboratories may include: measurement and evaluation; biomechanics (kinesiology); physiology of exercise; health education; safety education; motor learning and psychology of sports; recreation; and history and sociology (see Chapter 13).

RESIDENT OUTDOOR EDUCATION CENTER

- Planned for multiple use for various age levels and varied programs (see Chapter 15).
- Site selected carefully for isolation, yet limited accessibility with adequate and safe water supply.
- Adequate drainage and sewage disposal.
- Availability of utility lines.
- Fire protection available.

FIELD HOUSES

- Six-lane, 60-yard straightaway track, minimum of 60 yards plus sufficient distance for starting and stopping (see Chapter 17).
- Exit doors (width of running track) at end of straight-

away.

- An area approximately 125 feet wide is recommended for a practice baseball infield.
- Design meets the standards of accessibility, supervision, utility, and validity.
- Ample spectator egress and ingress, and efficient traffic patterns.
- Adequate accommodations for women.
- Square footage ample for the programs and services.
- Provision for maintenance of light fixtures.
- Doors and traffic areas adequate for movement of equipment.
- Elevator and/or some other lifting device provided where necessary.
- Latest research findings carefully considered before selecting types of flooring.

STADIUMS

- Consideration given as to best placement of athletic areas, such as track and field (see Chapter 19).
- Utilization of all space in, around, and under stadium.
- Future expansion plans.
- Minimum width of 24 inches for treads with backless seats; 30 inches for seats with backs.
- Aisles minimum width of 30 inches. If divided by a portal, minimum width of 24 inches on each side.
- All traffic areas allow ease of traffic flow.
- Focal points for sight lines: for football, nearest sideline; for track, knee height of runner in nearest lane; for baseball, several feet behind catcher; and for tennis, 4 feet outside boundary lines and 10 feet behind base lines.
- For stadium cleaning, recommended deck slope with drains and hose bibbs not more than 100 feet apart.
- At least one public telephone for every 3,000 spectators.
- Press box heated where necessary, and equipped with toilet facilities and ample electrical outlets.
- Elevator and/or some other lifting device provided for press box.
- Scoreboards and press and photographers' boxes located with proper relationship to sun.

ICE-SKATING FACILITIES

- Special attention given to mechanical services, refrigeration system, and unique heating and ventilation needs. Utilization of specialists and consulting engineers (see Chapter 16).
- Combination use of space well planned, such as tennis, badminton, and volleyball courts.
- Ice-maintenance equipment room adequate for oversize equipment, with oversize doors and extra ceiling height; adequate provision for steam and drainage needs.
- Skate-sharpening room, with proper exhaust and venting for dust problems.
- Ample storage space for rink boards and ice equipment during nonseason.
- Special recessed bases for rink boards imbedded in floor for necessary stability.
- If bleachers are used on main floor surrounding rink, movable roll-away bleachers are utilized out-of-season as dividers for teaching stations.
- Jacks for scoreboards, amplifying system, goal lights, and electrical outlets recessed and strategically located.
- Adequate protection from flying pucks.
- Automatic ice-making equipment used.
- Locker and drying rooms have adequate mechanical ventilation for ice-hockey uniforms. Ventilated, oversize lockers used.

APPENDIX I

THE STEPS IN BUILDING*

OWNER

1. Seeks architectural services
8. Approves schematic documents
14. Approves preliminary documents
15. Authorizes final documents
16. Approves special consultants, if any
27. Approves final documents
31. Receives bids
34. Awards contract
36. Executes contract
38. Arranges for waiver of liens
46. Pays construction costs monthly
49. Countersigns change orders
53. Receives release of liens
54. Makes final payment
55. Accepts building
56. Assumes maintenance

ARCHITECT

6. Program analysis
7. Schematic designs
9. Preliminary drawings
10. Preliminary specifications
11. Preliminary estimates
13. Revisions to preliminaries
18. Final working drawings
20. Final specifications
21. Final estimates
24. Revisions, if required
30. Issues documents for bidding
33. Advises on contract award
35. Assists in execution of contract
37. Approves bonds and insurance
39. Issues proceed letter to contractor
41. Supervises construction
42. Prepares field inspection reports
43. Reviews and approves shop drawings
44. Inspects and approves samples
45. Prepares monthly certificates
48. Prepares and signs change orders
51. Receives special guarantees from contractor
52. Makes final inspection

OWNER AND ARCHITECT

2. Preliminary conference
3. Owner/architect agreement
4. Establish building program
5. Set production time limits
12. Conference on preliminaries
- SPECIAL:** 17. 25% of fee now payable
19. Conference on specifications
22. Set construction time limit
23. Conference and review
- SPECIAL:** 25. Review by city, state, and federal groups
26. Conference and acceptance
- SPECIAL:** 28. 50% of fee now payable
29. Select contractors for bidding
32. Bid tabulation and review
40. Field construction begins
47. Review construction reports
- SPECIAL:** Emergencies
- SPECIAL:** Construction delays
- SPECIAL:** 50. 25% of fee prorated
57. Celebration

*Taken from *The Cost of a Schoolhouse*, Educational Facilities Laboratories, Inc., 477 Madison Avenue, New York, N.Y.

APPENDIX I

STANDARD FORM OF QUESTIONNAIRE FOR SELECTION OF ARCHITECTS FOR SCHOOL BUILDING PROJECTS*

A. Information by the school system to the architect:

1. Name of school system _____

2. Name of superintendent or other person to whom questionnaire should be returned: _____

3. Size of system (pupil enrollment) _____

4. General description of proposed projects: _____

5. Approximate timetable for planning & construction period: _____

B. Architect's questionnaire:

1. Name _____

2. Business address _____

3. Telephone number _____

4. Type of organization (check one) _____

☐ individual _____

☐ partnership _____

☐ corporation _____

AIA Document No. 371

*Approved by the National Council on Schoolhouse Construction and the American Institute of Architects and available from AIA, 1735 New York Avenue, N.W., Washington, D.C.

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5. Names of principals, professional history, professional affiliation, key personnel, staff organization:
(Attach information if you prefer.)

6. Attach list of completed buildings your firm has designed during recent years. If you have recently established your own practice, indicate prior responsible affiliation with other projects. Underline those which you feel are examples of your work appropriate to our problems & which you would like to have visited. Include cost of building, type of building, location & dates of construction. (Use separate sheet.)
7. Give names of persons to whom the board of education may write. These persons would have knowledge of your firm and your work:

8. Attach any other material which might help the board of education in giving your firm proper consideration. In questions 7 & 8, the board is interested in finding out about your:

- Integrity
- Thoroughness
- Creativeness
- Adequacy of supervision
- Business procedures & record keeping on the job
- Financial responsibility

9. If you are called in for an interview, you will be asked to furnish information indicating:
- That your organization is adequate to do the job.
 - That previous commitments will not prevent expeditious planning of this project.
 - That you are willing to devote time to carry out cooperative educational planning with designated school staff members or committees.
 - Completeness of contract documents (plans & specifications).

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TIME REQUIRED TO PLAN AND CONSTRUCT A SCHOOL BUILDING*

1. Selection of architect, consultant, and site:	one to four months
2. Preparation of program requirements for educational specifications:	one to six months
3. Time between receipt of program requirements and completion of preliminary plans:	two to six months
4. Time between preliminary plans and beginning of final drawings:	up to two months
5. Time from approval of preliminary plans to completion of final drawings and specifications:	two to ten months
6. Time between approval of final drawings and receipt of contractors' bids:	one and one-half to two months
7. Time from acceptance of bid to completion of the building:	twelve to twenty-four months

*Condensed from a study made by N.L. Engelhardt, Jr.

APPENDIX J

NEW EDUCATIONAL DIRECTIONS

Many large cities are currently engaged in extensive planning which will result in revitalizing city life. Projects for urban renewal, industrial plazas, business centers, housing developments, school-plant renewal, and park development are designed to revitalize urban living. Large areas, even in the heart of the city, are being cleared of old structures so that the land can be used for other purposes.

THE EDUCATION PARK, EDUCATION PLAZA, OR CAMPUS SCHOOL

Proposals for renewal of the school and community-college plants have included the development of larger centers for education, such as an education park, education plaza, or a campus school. Such centers are often planned to serve about 5,000 elementary or middle-school pupils. They include a complex of buildings located on a large site ranging from 50 to 150 acres. Sometimes the centers include high school and junior college students. Occasionally, the centers have included university students. They are usually planned so that they are functional for recreation.

City education officials are under great pressure to improve the scope and quality of education and to desegregate the public schools. The construction of new and improved schools is a key factor in relieving this pressure and in solving these problems. The improvement of the quality and scope of education, particularly the enrichment of the curriculum, is a major factor in solving desegregation problems. Good programs in health, physical education, recreation, and outdoor education are essential to such curriculum enrichment.

Broadly-conceived programs of health, physical education, recreation, and outdoor education can provide learning experiences which achieve desirable outcomes in citizenship, fair play, and teamwork that reinforce the foundation for good citizenship and character. Outcomes in skills, knowledges, and attitudes can prepare the individual for a lifetime of participation in recreation that is of benefit to both himself and society. The achievement of these outcomes can be a powerful force in the solution of civil-rights problems.

NEEDED FACILITIES

The health, physical education, recreation, and outdoor education facilities of an education park, education plaza, or a campus school should be more adequate than those of the schools it replaces. Most of the old and inadequate schools are located in the congested section of the city. A majority of them are over thirty years old. Most of them have small sites and substandard indoor physical education facilities. Such old and inadequate schools have stimulated parents to move into suburban areas where their

children will have better schools, thereby increasing desegregation problems.

The education park, education plaza, or campus school should be on a site which is large enough to compare favorably with that of the suburban schools. A suburban elementary school for 1,000 pupils generally has a site which has 10 or more acres of usable space for outdoor physical education and recreation. Therefore, a campus school or an education park for 5,000 elementary pupils should have 50 or more acres for such use. This center should have at least 12 indoor physical education teaching stations which are functional for recreation.

Recommendations, standards, and specifications for planning facilities for health, physical education, and recreation for the park-schools for the elementary, junior high, or senior high grades are included in the 1965 edition of the **Guide** prepared by the National Facilities Conference.*

LOCATION

The park-school concept, which is included in the 1965 **Guide**, holds that an elementary school should be located in a park-like setting and planned so that it is functional for a neighborhood center for recreation as well as education. Likewise, the junior or senior high school should be functional for a community education and recreation center. Such park-schools should be used on a year-round schedule, and be open for after-school and evening use during the school year. These education-recreation centers are well suited to the extended school year, whether it be the enriched summer school or the arrangement of the school year by quarters.

The education park or plaza is, in essence, a complex of elementary park-schools located on large land areas cleared by urban renewal, or in open spaces which are available near the edge of a city. Such parks or plazas cannot serve the purpose of enriching and improving the quality of education, or in solving the problems of desegregation, if they are located on sites which are too small for a good program of outdoor physical education and recreation.

Outdoor education centers or school camps can serve effectively as education parks or plazas. A city that is planning for the development of several education parks should also plan for some outdoor education centers. Such centers have great potential values for the enrichment of education and in solving problems of integration. A week or two in camp will be beneficial to all children in the middle grades, particularly for culturally-deprived children from the homes of the low-income families.

*Planning Areas and Facilities for Health, Physical Education, and Recreation, The Athletic Institute, 805 Merchandise Mart, Chicago, Ill. 60654, and the American Association for Health, Physical Education, and Recreation, 1201 Sixteenth Street, N.W., Washington, D.C. (20036), 1965.

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COOPERATIVE PLANNING BY CITY AGENCIES

The various agencies of a city which are responsible for planning the facilities for schools, parks, urban renewal, housing, industrial parks, and business plazas should have a share in developing the master plan for the city. For example, park and education officials, through cooperative planning, can get more adequate sites and space for education and recreation. The park-school or its larger counterpart, the education park, can supplement the recreation areas in the parks. Such an education center can also provide the facilities for teaching and learning the skills, knowledge, and attitudes so important for a lifetime of participation in recreation.

Likewise, by cooperative planning, education, urban renewal, park, and housing officials can achieve more of their goals. Renewal of the city is not complete or effective without good schools and park centers.

Recent advancements in knowledge and technology have resulted in more individuals with disabilities being motivated to pursue a college education. Each year an increasing number of colleges and universities are extending themselves to make their offerings available to all qualified and deserving people. The development and implications of "continuing education" add further significance to the need and desirability of designing college and university facilities for everyone, including the disabled and the aging (see Appendix G).

SCHOOLS FOR DEMONSTRATION, OBSERVATION, AND RESEARCH

Colleges and universities often have elementary and secondary schools for demonstrations, observations, and research in the professional preparation of public-school personnel. Such schools are needed even though the university has arranged with some of the best public schools for internship or practice teaching by teacher trainees.

College and university demonstration schools should be superior to the best public schools, otherwise they cannot be used effectively in the demonstration, observation, and research needed to improve the scope and quality of public education. Since the programs of health, physical education, recreation, and outdoor education are relatively new additions to the public-school curriculum, facilities for these programs are often substandard. Colleges and universities can help to improve these programs by providing superior facilities to accommodate them in their demonstration schools.

Recommendations, specifications, and standards for health, physical education, recreation, and outdoor education facilities in elementary and secondary schools are not included in this **Guide** for planning college and university facilities. However, the 1965 edition of the **Guide** for school and community facilities does include such recommendations and standards.* Therefore, it is recommended that college and university officials use the 1965 **Guide** in planning facilities for demonstration schools.

*Ibid.

APPENDIX K

AGENCIES PROVIDING RESOURCE MATERIALS FOR OUTDOOR EDUCATION

American Association for Health, Physical Education, and Recreation, 1201 Sixteenth St., N.W., Washington, D.C. (20036).

American Camping Association, Bradford Woods, Martinsville, Ind. (46151).

American Casting Association, P.O. Box 51, Nashville, Tenn. (37202).

American National Red Cross, Seventeenth and D Streets, N.W., Washington, D.C. (20006).

Boy Scouts of America, New Brunswick, N.J. (08903).

National Archery Association, P.O. Box 832, Norristown, Penna. (19404).

National Council of the Young Men's Christian Association, 291 Broadway, New York, N.Y. (10007).

National Field Archery Association, Route 2, Box 514, Redlands, Calif. (92373).

National Rifle Association, 1600 Rhode Island Ave., N.W., Washington, D.C. (20036).

Sport Fishing Institute, Bond Building, Washington, D.C. (20005).

APPENDIX L

SOURCES OF RESEARCH EQUIPMENT AND MATERIALS*

LABORATORY EQUIPMENT SOURCES

ANTHROPOMETRIC (physique, posture, foot, etc.)

Anatomical Chart Co., 5728 Blackstone Avenue, Chicago, Ill. (60637) (charts).
 Cambridge Scientific Industries, Inc., 19 Poplar Street, Cambridge, Md. (21613) (Lange skinfold calipers).
 C. H. Stoelting Co., 424 North Homan Avenue, Chicago, Ill. (60624) (calipers and anthropometers).
 Central Scientific Co., 1700 Irving Park Road, Chicago, Ill. (60613) (calipers and anthropometers).
 Clay-Adams Co., Inc., 141 East 25th Street, New York, N.Y. (10010) (skeletons and models).
 Denoyer-Geppert Co., 5235-39 Ravenswood Avenue, Chicago, Ill. (60640) (anatomical charts, models, skeletons, etc.).
 Gersmehl, V. R., 3817 Warren Avenue, Cheyenne, Wyo. (82001) (skinfold calipers).
 Gilliland Instrument Co., 3124 East 14th Street, Oakland, Calif. (94601) (anthropometric calipers).
 H. E. Morse Co., 455 Douglas Avenue, Holland, Mich. (49423) (harpender skinfold caliper).
 J. A. Preston Corporation, 175 Fifth Avenue, New York, N.Y. (10010) (anthropometers).
 Keuffel and Esser Co., 500 Central, Northfield, Chicago, Ill. (planimeters, skin pencils).
 Leighton Flexometer, 1321 East 55th, Spokane, Wash. (99203) (flexometers).
 Lightning-Lite Co., 14414 Detroit Avenue, Lakewood, Ohio (44107) (somatotype pedestal).
 Narragansett Gymnasium Equipment Co., 110 West Carpenter Street, Moberly, Mo. (65270) (stadiometers, scales, calipers, etc.).
 Newark Pedometer Co., 95 Monroe Street, Newark, N.J. (07105) (pedometers).
 Nissen-Medart Corp., 930 27th Avenue, S.W., Cedar Rapids, Iowa (52404) (stadiometers, scales, etc.).
 Syd Meadows Physical Fitness Co., 2460 Warrensville Road, Cleveland, Ohio (44118) (calipers).
 The Scholl Manufacturing Co., Inc., 62 West 14th Street, New York, N.Y. (10011) (pedograph).
 Toledo Scale Co., Toledo, Ohio (weighing scales).
 University of Iowa, Iowa City, Iowa (Dr. Howard Meredith, East Hall) (52240) (stadiometer charts).
 W. M. Welch Scientific Co., 7300 Linder Avenue, Skokie, Ill. (60076) (charts and models).

CINEMATOGRAPHY

All-American Productions and Publishers, P.O. Box 91, Greeley, Colo. (80631) (films and motion-picture projectors).
 American Chronoscope Corporation, 216 West First Street, Mount Vernon, N.Y. (10550) (timing devices).
 Arriflex Corporation of America, 257 Park Avenue, New York, N.Y. (10010) (cameras).
 Beaulieu, 921 Westwood Boulevard, Los Angeles, Calif. (90024) (cameras).
 Beckman & Whitley, San Carlos, Calif. (cameras).
 Bell & Howell Co., 7100 McCormick Road, Chicago, Ill. (60645) (cameras, projectors, and film viewers).
 Benson-Lehrner Corporation, 14761 Califa Street, Van Nuys, Calif. (91401) (motion analyzers, film readers, & viewers).
 Burke & James, Inc., 321 South Wabash Avenue, Chicago, Ill. (60604) (photographic equipment).

C. M. Marchioni, Rutherford, N.J. (tripods).
 Camera Equipment Co., Inc., 315 West 43rd Street, New York, N.Y. (10036) (camera rentals and sales).
 Charles Beseler Company, 219 South 18th Street, East Orange, N.J. (07018) (enlargers, opaque projectors).
 D. B. Milliken, 131 North 5th Avenue, Arcadia, Calif. (91006) (cameras).
 Division of Highway Studies: Institute for Research, State College, Pa. (16801) (pictorial data transducers).
 Eastman Kodak Co., Rochester, N.Y. (cameras, projectors).
 F and B/Ceco, Inc., 315 West 43rd Street, New York, N.Y. (10036) (camera rentals and sales).
 Lightning-Lite Co., 14414 Detroit Avenue, Lakewood, Ohio (44107) (photographic equipment).
 Microcard Reader Corporation, 365-70 South Oak Street, West Salem, Wis. (54669) (pocket-size microcard reader, wt. 7 ounces, operates on battery or plug-in).
 Mitchell Camera Corporation, 666 West Howard Street, Glendale, Calif. (cameras).
 Paillard Inc., 1900 Lower Road, Linden, N.J. (07036) (bolex motion-picture cameras, 8 & 16 mm.).
 Recordak Corporation, 847 West Jackson Boulevard, Chicago, Ill. (60607).
 Revere-Wollensak Division, 3M Co., 2501 Hudson Road, St. Paul, Minn. (55119) (cameras).
 Richardson Camera Company, 2201 West Desert Cove, Phoenix, Ariz. (85029) (cameras, motion analyzers).
 Simon Brothers, Inc., 30-28 Starr Avenue, Long Island City, New York (11101) (enlargers).
 Specto Ltd., Vale Road, Windsor, England (500 watt, 16 mm. projector with superior single-frame projection, and two frames per second and standard speed—good for loop films and skill analysis).
 Stacor Corporation, 285 Emmett Street, Newark, N.J. (07114) (stacor TR 16 drawing board—table top illuminator for reading x-ray films, tracing, etc.).
 Texas Instruments, Inc., 13500 North Central Expressway, Dallas, Tex. (75231) (motion analyzers, film readers, and viewers).
 Triad Corporation, 777 Flower Street, Glendale, Calif. (91201) (stop action cameras, oscilloscopes).
 Quickset, Inc., 8121 North Central Avenue, Skokie, Ill. (60076) (motion-picture accessory equipment).
 Vanguard Instrument Corporation, 20 West Centennial Avenue, Roosevelt, N.Y. (11575) (motion analyzers, film readers, and viewers) (represented by Triad Corporation).
 Wittnauer Instruments Division, 580 Fifth Avenue, New York, N.Y. (10036) (8 mm. camera-projector combination).

MOTOR FITNESS (strength, agility, flexibility, power, endurance, balance, speed, and accuracy)

A. E. Gay, R. D. 4 Chestnut Ridge, Lockport, N.Y. (14094) (Gay apparatus for girls' pull-ups).
 A. R. Young Co., 520 North Dorman Street, Indianapolis, Ind. (46202) (treadmill).
 Aircraft Components, Inc., Benton Harbor, Mich. (49022) (cable tension accessories).
 American Chronoscope Corp., 316 West First Street, Mt. Vernon, N.Y. (10550) (timing devices).
 Ann Arbor Instrument Works, 1200 Rosewood Street, Ann Arbor, Mich. (48104) (dynamometers).
 Barber-Greene Co., 400 North Highland Avenue, Aurora, Ill. (60506) (trainer, 2' x 12', placed 18" above the floor).

*This list was prepared by J. Grove Wolf of the Department of Physical Education, University of Wisconsin, for the Research Council of the American Association for Health, Physical Education, and Recreation.

APPENDIX L

Battle Creek Equipment Co., Battle Creek, Mich. (health walker, rehabilitation equipment, Muller Permagbicycle ergometer).

Brailsford & Company, Inc., Milton Point, Rye, N.Y. (10580) (timers).

C. H. Stoelting Co., 424 North Homan Avenue, Chicago, Ill. (60624) (dynamometers, fleximeters, etc.).

Carey Sacle, 714 Hamburg Turnpike, Pompton Lakes, N.J. (07442) (calibrator for tensiometers).

David Wexler & Co., 1243 South Wabash Avenue, Chicago, Ill. (60605) (Franz metronome).

Dekan Timing Device Co., P.O. Box 712, Glen Ellyn, Ill. (60137) (athletic performance analyzer).

Dimco-Gray Co., 207 East 6th Avenue, Dayton, Ohio (45402) (Graylab timers).

Elgin Exercise Appliance Co., P.O. Box 132, Elgin, Ill. (60120) (muscle-testing equipment).

Esterline-Argus Co., Indianapolis, Ind. (motor-fitness testing equipment).

Fisher Scientific Co., 711 Forbes Street, Pittsburgh, Pa. (15219) (timers).

Franz Manufacturing Co., Inc., New Haven, Conn. (metronome).

Hale-Reaction Performance Timer, P.O. Box 1127, Williamsport, Pa. (17701) (reaction timer).

Harvard Instrument Co., Dover, Mass. (02030) (motor-fitness testing equipment).

Hunter Manufacturing Company, Inc., Quarry Road, Coralville, Iowa (52240) (timing and counting devices).

Instrumentation Associates, Inc., 16 West 60th Street, New York, N.Y. (10023) (Godart-Landon ergometer).

John Chatillon & Sons, 85 Cliff Street, New York, N.Y. (10038) (dynamometers, calibrators, scales).

Lafayette Instrument Co., North 26th Street and 52 By-Pass, Lafayette, Ind. (grip dynamometers).

Leighton Flexometer, Inc., 1351 East 55th Avenue, Spokane, Wash. (99203) (flexometers).

M. Ducommun Co., 580 5th Avenue, New York, N.Y. (10036) (stopwatches).

Maroth Engineering Co., Wilton, Conn. (06897) (precision gauge bat - m.p.h.).

Meylan Stopwatch Co., 264 West 40th Street, New York, N.Y. (10018) (stopwatches, stopwatch boards and stands, tachometers).

Milhard Engineering Co., Inc., 13619 Saticoy Street, Van Nuys, Calif. (91402) (bicycle ergomatic).

Monark A. B. Cykel Fabriken, Varberg, Sweden (mechanical bicycle ergometer—delivered in Boston or New York).

Narrangansett Gymnasium Equipment Co., 110 West Carpenter Street, Moberly, Mo. (65270) (dynamometers, fleximeter sticks, etc.).

Nissen-Medart Co., 3535 DeKalb Street, St. Louis, Mo. (63118) (dynamometers, fleximeter sticks, manometers).

Pacific Scientific Co., 6280 Chalet Drive, Bell Gardens, Calif. (90202) (tensiometers).

Polzer, John O., 4739 North 19th Street, Milwaukee, Wis. (53209) (joint motion instruments, goniometers, etc.).

Porto-Clinic Instruments, Inc., 298 Broadway, New York, N.Y. (10007) (reaction timers).

Standard Electric Time Co., Springfield, Mass. (01101) (100-second timer).

Statham Laboratories, 12401 West Olympic Boulevard, Los Angeles, Calif. (90064) (instruments for measuring acceleration, displacement, etc.).

The Zimmer Manufacturing Co., Warsaw, Ind. (46580) (goniometers, etc.).

Tracer Lab., Inc., Route 128, Waltham, Mass. (02154) (timers, etc.).

W. C. Dillon and Co., Inc., 14602 Keswick Street, Van Nuys, Calif. (91405) (weight indicators, including dynamometers).

W. E. Quinton Instrument Co., 3051 44th Avenue West, Seattle, Wash. (98199) (aluminum treadmill, model 18-49, 3/4 H.P., 110 volts, 60 cycle A.C. electronic bicycle ergometers).

W. J. Voit Rubber Company (subsidiary of American Machine & Foundry Company), 315 East Grand Avenue, Chicago, Ill. (60611) (isometric exercise and testing equipment).

PHYSIOLOGICAL (cardiovascular, respiratory, etc.)

A. S. Aloe Co., Nineteenth and Olive Streets, St. Louis, Mo.; 1150 South Flower Street, Los Angeles, Calif. (90015) (laboratory supplies, hemoglobinometer).

Allen B. DuMont Laboratory, Inc., 760 Bloomfield Avenue, Clifton, N.J. (07012) (cathode ray and other electrical equipment).

American Electronics Laboratories, Inc., 1303 Richardson Road, Lansdale, Pa. (19446) (temperature telemeter; also EKG & other telemetering devices).

American Hospital Supply Corp., 2020 Ridge Avenue, Evanston, Ill. (60201) (general equipment).

American Meter Company, 13500 Philmont Avenue, Philadelphia, Pa. (19116) (portable respiratory and test meter gives amount of air breathed in a given period; can be connected to a Beckman Analyzer).

Arthur Thomas Co., Box 779, Philadelphia, Pa. (physiological and other scientific equipment).

Avionics Research Corporation, 6901 West Imperial Highway, Los Angeles, Calif. (telemetry system).

Baldwin-Lima-Hamilton Corporation, Waltham, Mass. (02514) (load cells, transducers, strain gauges).

Bausch and Lomb Optical Co., Rochester, N.Y. (microscopes, blood-analysis equipment).

Beckman Instruments, Inc., 1020 Mission Street, South Pasadena, Calif. (91030) (Beckman oxygen analyzer); Box 473, Bellevue, Wash. (98004) (oxygen analyzer E₂); Spinco Division, Palo Alto, Calif. (oxygen microelectrode); Offner Division, 3900 River Road, Schiller Park, Ill. (60176) (electromyographic and other electronic equipment, including custom building).

Becton, Dickinson & Co., Rutherford, N.J. (florimeters, stethoscopes, etc.).

Biocom, Inc., 5883 Blackwelder Street, Culver City, Calif. (90230) (pulse transducer, electromyographic equipment).

Biotronics, Box 2987, Newport Beach, Calif. (electromyography monitors).

Birtcher Corporation, 4371 Valley Boulevard, Los Angeles, Calif. (90032) (electromyography stimulators).

Brailsford and Company, Inc., Milton Point, Rye, N.Y. (10580) (sequence timers).

Brush Instruments, 3405 Perkins Avenue, Cleveland, Ohio (44114) (single as well as multichannel recorders, tape recorders).

Burdick Corporation, Milton, Wis. (53563) (ultraviolet lights, electrocardiographs, physical therapy and electrotherapy equipment).

C. H. Stoelting Co., 424 North Homan Avenue, Chicago, Ill. (60624) (galvanic skin-response equipment, psychological and physiological apparatus).

Calhear Instruments Co., 4024 Fountain Avenue, Los Angeles, Calif. (90029) (sphygmomanometers).

Cambridge Instrument Co., Inc., Graybar Building, New York, N.Y. (continuous blood-pressure apparatus).

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- Cameron Heartometer Corporation, 6449 North Newark Avenue, Chicago, Ill. (60631).
- Central Scientific Co., 1700 Irving Park Road, Chicago, Ill. (60613) (cardiorespiratory equipment).
- Chemtronics, Inc., Box 417, San Antonio, Tex. (oxygen transducers).
- Clark Electronic Laboratories, Box 165, Palm Springs, Calif. (92262) (pressure-sensitive paints).
- Coleman Instruments, Inc., 42 Madison Street, Maywood, Ill. (60153) (anoxia photometer).
- Colson Corporation, Elyria, Ohio (44035) (plethysmographs, automatic blood-pressure recorders, cardiometers).
- Consolidated Engineering Corporation, 620 North Lake Avenue, Pasadena, Calif. (91101) (oscillographs, telereader, etc.).
- Cordis Corporation, 241 Northeast 36th Street, Miami, Fla. (33137) (imyograph).
- Crystal Research Laboratories, 29 Allyn Street, Hartford, Conn.; Distributor-O. David Wexler & Co., 1243 South Wabash Avenue, Chicago, Ill. (60605).
- Dallons Laboratories, Inc., 120 Kansas Street, El Segundo, Calif.
- Dekan Timing Devices Company, Box 712, Glen Ellyn, Ill. (60137) (automatic performance analyzer).
- E. & M. Instrument Co., Inc., 6030 England Street, Houston, Tex. (77021) (physiographs, transducers, physiological equipment).
- E. F. Mahady Co., 851 Boylston Street, Boston, Mass. (02116) (scientific medical instruments).
- Eico Electronics Instrument Co., Queens Plaza, Long Island City, N.Y. (oscilloscope).
- Electro-Medical Engineering Co., 703 Main Street, Burbank, Calif. (91506) (wedge spirometer, miniature spirometer, nitrogen analyzer).
- Electro-Medical Laboratory, Inc., South Woodstock, Vt. (05071) (electroencephalograph, electromyographs).
- Endevco Corporation, 801 South Arroyo Parkway, Pasadena, Calif. (91105) (transducers and accelerometers).
- Epsco Medical, 275 Massachusetts Avenue, Cambridge, Mass. (02139) (telemetry).
- Fisher Scientific Co., 711 Forbes Street, Pittsburgh, Pa. (15219) (gas analyzers, blood-analysis equipment).
- Franz Manufacturing Co., New Haven, Conn. (electric metronome).
- G. Schirmer, Inc., 3 East 43rd Street, New York, N.Y. (10017) (electric metronome).
- George T. Walker & Co., 324 Fifth Avenue, South, Minneapolis, Minn. (55415) (cardiorespiratory equipment).
- Gilford Instrument Laboratories, Inc., Elyria, Ohio (44035) (cardiometer, spectral recording and other procedures).
- Gilson Medical Electronics, 3000 West Beltline Highway, Middleton, Wis. (53562) (eight-channel EEG and recorder).
- Grass Instrument Co., 101 Old Colony Avenue, Quincy, Mass. (02169) (electrocardiographs, multichannel electroencephalographs, myograph action current machines).
- Gulton Industries, Inc., 212 Durham Avenue, Mauchon, N.J.
- Harvard Apparatus Co., Dover, Mass. (02030) (kymograph, signal markers, etc.).
- Hebel, Otto K., Scientific Instruments, 80 Swarthmore Avenue, Rutledge, Pa. (19070) (gas analyzers).
- Honeywell, Heland Division, 4800 East Dry Creek Road, Denver, Colo. (galvanometers, recording oscillographs).
- Hughes Aircraft Co., Aero Space Group, Flight Test Division, Clover City, Calif.
- Hunter Manufacturing Co., Inc., Quarry Road, Caralville, Iowa (52243) (physiological, psychological test devices).
- Hydro-Tex Corporation, 939 West Wilson Avenue, Chicago, Ill. (60640) (Douglas bags).
- Industrial Development Laboratories, Inc., 17 Pollock Avenue, Jersey City, N.J. (07305) (Ballistocardiograph).
- Instrumentation Associates, 17 West 60th Street, New York, N.Y. (10023) (spirometer, CD-4).
- Interstate Drug Exchange, 1922 Utica Avenue, Brooklyn, N.Y. (11234) (sphygmomanometers, pressure cuffs) (available only through a physician).
- Janke Aircraft Engine Test Equipment Co., 38 Railroad Avenue, Hackensack, N.J. (07601) (photometer).
- Jarrell-Ash Co., Boston 16, Mass. (scientific instruments, microscopes).
- Kenelco, Inc., 1753 Cloverfield Boulevard, Santa Monica, Calif. (90404) (capacitance plethysmograph).
- Lafayette Instrument Co., P.O. Box 1279, North 9th Street Road and 52 By-Pass, Lafayette, Ind. (47902) (interval timers, repeat cycle timers, etc.).
- LaBerne Manufacturing Co., Box 245, Columbia, S.C. (walk-off, standing-tilt tables).
- Leeds and Northrup, 4901 Stenton Avenue, Philadelphia, Pa. (19144) (potentiometer 11 volts).
- McKesson Appliance Company, 2228 Ashland Avenue, Toledo, Ohio (43620) (metabolism apparatus).
- Medican Equipment Co., 1036 N.E. 6th Avenue, Portland, Ore. (97232) (Jones Multi-Basal machine).
- Medicon, 2800 North Figueroa Street, Los Angeles, Calif. (90065) (electromagnetic blood flowmeter).
- Meditron Co., 708 South Fair Oaks Avenue, Pasadena, Calif. (91105) (electromyograph).
- Med-Science Electronics, Inc., 2647-49 Locust Street, St. Louis, Mo. (63103) (nitrogen gas analyzers, spirometers, gas samplers).
- Narragansett Gymnasium Equipment Co., 110 West Carpenter Street, Moberley, Mo. (65270) (spirometers).
- Newport Laboratories, P.O. Box 2087, Newport Beach, Calif. (92663) (EMG, sensitivity 1.0 MV — integrating bioelectric monitor amplifier suitable for EKG, EEG, as well as EMG by switching frequency spectrums).
- Nissen-Medart Corp., 930 27th Avenue, S.W., Cedar Rapids, Iowa (52404) (spirometers).
- Non-Linear Systems, Inc., Del Mar, Calif. (92014) (digital voltmeters and other electrical equipment).
- Olander, Roland & Co., 6313 Santa Monica Boulevard, Los Angeles, Calif. (90038) (Offner West representative — electromyography).
- Owen Laboratories, 412 Woodward Boulevard, Pasadena, Calif. (91107) (time calibrators, etc.).
- Pacific Scientific Co., 6280 Chaleet Drive, Bell Gardens, Calif. (90202) (tensiometer).
- Parks Electronic Laboratory, Route 2, Box 35, Beaverton, Ore. (97005) (telemetry, heart monitors, etc.); 1218 S.E. 7th Avenue, Portland, Ore. (97214).
- Phipps and Bird, Inc., 303 South 6th Street, Richmond, Va. (23219) (metronomes, kymographs, plethysmographs, pneumographs).
- Porto-Clinic Instruments, Inc., 11 West 52nd Street, New York, N.Y. (10019) (reaction-time test equipment).
- Precision Scientific Co., 3737 West Cortland Street, Chicago, Ill. (60647) (gas meters).
- S.L.E. Specialized Laboratory Equipment, 20 Sydenham Road, Croydon, Surrey, England (electrodes).
- Sanborn Co., 172 Wyman Street, Waltham, Mass. (02154) (electrocardiograph, metabolators, plethysmograph amplifier with 780-7A patent monitor — picks up pulse rate from ear lobe which can be read directly on a meter).
- Scientific Supplies, 3950 N.W. Yeon, Portland, Ore. (97210) (Douglas metabolism apparatus, Beckman PH meter, electric stop timer).

APPENDIX L

Space Labs Inc., 15521 Lanark Street, Van Nuys, Calif. (91406) (telemetry equipment).

Statham Laboratories, 12401 West Olympic Boulevard, Los Angeles, Calif. (90064) (Bulletin No. 1.0—a complete list of manufacturers who make microammeters, light-beam galvanometers, cathode-ray oscilloscopes and oscillographs, potentiometers, recording potentiometers, resistance thermometers or ratio recorders, photographic recording galvanometers and oscillographs, recording string galvanometers - electrocardiographs, direct writing galvanometers, D.C. amplifiers, and carrier amplifiers).

Taylor Instrument Co., Rochester, N.Y. (sphygmomanometers, clinical thermometers, etc.).

Telemedics Inc., Southampton, Pa. (18966) (EGG, EEG, EMG, electro-oculogram, blood-flow data, phonocardiogram, respiration function and goniometric data).

The Dann Co., 2014 E. 46th Street, Cleveland, Ohio (44103).

The Decker Corporation, Bala-Cynwyd, Pa. (19004) (caudal plethysmograph).

The Edin Co., Inc., 207 Main Street, Worcester, Mass. (01608) (electrocardiographs, electroencephalographs).

The Garrett Corp., 9851 Sepulveda Boulevard, Los Angeles, Calif. (sphygmomanometer).

The Technicon Cardiograph Corp., 215 East 149th Street, New York, N.Y. (cardiograph).

Theodore M. Long, Engineering Specialties, 40 South Bridge Street, Somerville, N.J. (08876) (chronographs).

U.M.A., Inc., 376 Lafayette Street, New York, N.Y. (10003) (sphygmomanometers, thermocycle).

University of Southern California, Human Centrifuge and Environmental Laboratories, 815 West 37th Street, Los Angeles, Calif. (90007) (telemetering).

V. Mueller Co., 330 South Honore Street, Chicago, Ill. (medical and surgical supplies, including stethoscopes, sphygmomanometers).

W. A. Baum Co., Inc., New York, N.Y. (blood-pressure instruments).

W. L. Richards Co., 8500 Research Road, Austin, Tex. (78758) (knee-ligament testing equipment for collateral ligament).

Warren E. Collins, Inc., 555 Huntington Avenue, Boston, Mass. (02115) (spirometers, metabolic equipment, treadmills).

Waters Corp., Electro-Medical Instrument Division, 402 First Avenue, N.W. Rochester, Minn. (55901) (oximeters, cardiometers, kymograph recording cameras).

SENSORY TESTS

American Optical Company, Buffalo, N.Y. ("sightscreener," Massachusetts Vision Test).

Bausch and Lomb Optical Company, Rochester, N.Y. ("orthorater").

C. H. Stoelting Company, 424 North Homan, Chicago, Ill. (60624) (sensory test equipment).

Industrial Acoustics Co., Inc., 341 Jackson Avenue, New York, N.Y. (10002) (audio equipment).

Keystone View Company, Meadville, Pa. (16335) (Keystone telebinocular).

Maico Audiometer, Minneapolis, Minn. (audiometer).

National Safety Council, 425 North Michigan Avenue, Chicago, Ill. (60611) (driver-education reaction timer).

National Society for Prevention of Blindness, 1790 Broadway, New York, N.Y. (10019) (Snellen Chart).

Sonotone Corporation, Elmsford, N.Y. (10523) (audiometer).

Welch Allyn, Inc., Skaneateles, N.Y. (13152) (Massachusetts Vision Test).

Williamson Development Co., Inc. 317 Main Street, West Concord, Mass. (01781) (dolorimeter for pain threshold).

GUIDES FOR MEASUREMENT, STATISTICS, AND RESEARCH DESIGN

Adrian, M.; Tipton, C.M.; and Karpovich, P.V., **Electrogoniometry Manual**. Springfield, Mass.: Springfield College (02709), 1965.

Ahman, J. S.; and Glock, M.D., **Evaluating Pupil Growth**. Boston: Allyn and Bacon, Inc., 1959.

Ahman, J. S., et al, **Evaluating Elementary School Pupils**. Boston: Allyn and Bacon, Inc., 1960.

Aids for Physical Education, Athletics, and Recreation. Chicago: The Athletic Institute, 805 Merchandise Mart (60654).

Alexander, Carter, and Burke, A. J., **How To Locate Educational Information and Data**. New York: Bureau of Publications, Teachers College, Columbia University (10025), 1951. American Medical Association, 535 North Dearborn Street, Chicago, Ill. (60610) (pamphlets, Physical-Growth Record Form, etc.).

American Physiological Society. **Handbook of Physiology**. Five sections: (a) neurophysiology (3 volumes); (b) circulation (3 volumes); (c) respiration (2 volumes); (d) adaptation to the environment (1 volume); (e) adipose tissue (1 volume). Baltimore: Williams and Wilkins Co.

Ammons, R. B., **Psychological Reports, Perceptual and Motor Skills**. Louisville: Southern Universities Press (periodical, published four times per year).

Barnes, F. P., **Research for the Practitioner in Education**. Washington, D.C.: National Education Association (20036), 1964.

Barr, A. S.; Davis, R. A.; and Johnson, P. O., **Educational Research and Appraisal**. Chicago: J. B. Lippincott Co., 1953.

Barrow, Harold M., and McGee, Rosemary, **A Practical Approach to Measurement in Physical Education**. Philadelphia: Lea and Febiger, 1964.

Bayer, L. M., and Bayley, N., **Growth Diagnosis**. Chicago: University of Chicago Press, 1959. (selected methods of interpreting and predicting physical development from one to eighteen).

Bean, Kenneth L., **Construction of Educational and Personnel Tests**. New York: McGraw-Hill Book Co., 1953.

Blommers, Paul, and Lindquist, E. F., **Elementary Statistical Methods**. Boston: Houghton Mifflin Company, 1960.

Borko, Harold, **Computer Applications in the Behavioral Sciences**. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1962.

Carlson, C. R., et al., **An Educational Statistics Primer**. Madison: Dembar Publications, Inc., 1956.

Clarke, H. H., **Application of Measurement to Health and Physical Education**. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1959.

_____, **Cable-Tension Strength Tests**. Springfield, Mass.: Stuart E. Murphy, 1953.

Clarke, H. H., and Clarke, D. H., **Developmental and Adapted Physical Education**. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1963.

Cochran, William G., **Sampling Techniques**. New York: John Wiley and Sons, Inc., 1953.

Cochran, W. G., and Cox, G. M., **Experimental Design**. New York: John Wiley and Sons, Inc., 1957.

Consolazio, C. F.; Johnson, R. E.; and Pecora, L. J., **Physiological Measurements of Metabolic Functions in Man**. New York: McGraw-Hill Book Co., 1963.

Cooley, William W., and Lohnes, Paul R., **Multivariate Procedures for the Behavioral Sciences**. New York: John Wiley and Sons, Inc., 1962.

Cooperative Study of Secondary School Standards, Evaluative Criteria. Washington, D.C.: National Education Association (20036), 1950.

APPENDIX L

- Cronbach, Lee J., **Essentials of Psychological Testing**. New York: Harper and Brothers, 1960.
- Cureton, T. K., **Physical Fitness Appraisal and Guidance**. St. Louis: C. V. Mosby Co., 1948.
- _____, **Physical Fitness Workbook**. St. Louis: C. V. Mosby Co., 1947.
- Cureton, T. K., et al, **The Physical Fitness of Champion Athletes**. Urbana, Ill.: University of Illinois Press, 1951.
- Davis, Frederick B., **Educational Measurements and Their Interpretation**. Belmont, Calif.: Wadsworth Publishing Co., 1964.
- Dixon, W. J., and Massey, Frank, Jr., **Introduction to Statistical Analysis**. New York: McGraw-Hill Book Co., 1957.
- Downie, N. M., and Heath, R. W., **Basic Statistical Methods**. New York: Harper and Brothers, 1959.
- Ebel, Robert L., **Measuring Educational Achievement**. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1965.
- Edwards, A. L., **Experimental Design in Psychological Research**. New York: Rinehart and Co., Inc., 1964.
- _____, **Statistical Analysis**. New York: Rinehart and Co., Inc., 1958.
- _____, **Statistical Methods for the Behavioral Sciences**. New York: Rinehart and Co., 1963.
- Ferguson, George A., **Statistical Analysis in Psychology and Education**. New York: McGraw-Hill Book Co., 1959.
- Fisher, R. A., and Yates, F., **Statistical Tables for Biology, Agriculture, and Medical Research**. London: Oliver and Boyd, 1953.
- Fleishman, Edwin A., **The Structure and Measurement of Physical Fitness**. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1964.
- Gage, N. L., (editor), **Handbook of Research in Teaching**. Chicago: Rand McNally and Co., 1963.
- Garrett, H. E., **Statistics in Psychology and Education**. New York: David McKay Co., 1958.
- Garvin, E. L., **Bibliography on High Speed Photography**. Rochester, N.Y.: Eastman Kodak Co., 1960.
- Good, C. V., and Scates, D. E., **Methods of Research**. New York: Appleton-Century-Crofts, Inc., 1954.
- Greulich, W. W., and Pyle, S. I., **Radiographic Atlas of Skeletal Development of the Hand and Wrist**. Stanford, Calif: Stanford University Press, 1959.
- Guide to Scientific Instruments**. Washington, D.C.: American Association for the Advancement of Science, 1515 Massachusetts Avenue, N.W. (20005).
- Guilford, J. P., **Fundamental Statistics in Psychology and Education**. New York: McGraw-Hill Book Co., Inc., 1965.
- Harris, Chester W., (editor), **Problems in Measuring Change**. Madison: University of Wisconsin Press, 1963.
- Hays, W. L., **Statistics for Psychologists**. Chicago: Holt, Rinehart, and Winston, 1963.
- Health, Physical Education, and Recreation Microcards**. Eugene, Ore.: School of Health, Physical Education, and Recreation, University of Oregon (97403) (Fall Bulletin and Spring Supplement).
- Holzinger, Karl J., **Statistical Tables for Students in Education and Psychology**. Chicago: The University of Chicago Press, 1951.
- Hyzer, William C., **Engineering and Scientific High Speed Photography**. New York: The MacMillan Co., 1962.
- Instrument and Apparatus News**, 845 Ridge Avenue, Pittsburgh, Pa. (15212) (electronic and mechanical components, instruments and scientific equipment).
- Johnson, P., and Jackson, W. B., **Modern Statistical Methods: Descriptive and Inductive**. Chicago: Rand McNally and Co., 1959.
- Johnson, Palmer O., and Jackson, R. W., **Introduction to Statistical Methods**. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1953.
- Kelly, Harriet J., **Anatomic Age and Its Relation to Stature**. University of Iowa Studies in Child Welfare, XIII. Iowa City: State University of Iowa, 1937. (estimating age from hand X-rays).
- Kelly, Helen G., **A Study of Individual Differences in Breathing Capacity in Relation to Some Physical Characteristics**. University of Iowa Studies in Child Welfare, VII. Iowa City: State University of Iowa, 1933.
- Kemphorne, O., **The Design and Analysis of Experiments**. New York: John Wiley and Sons, Inc., 1952.
- Kendall, M. G., **Rank Order Correlation Methods**. London: Griffith Co., 1948.
- _____, **The Advanced Theory of Statistics**. New York: Hafner Publishing Co., 1951.
- Kerlinger, Fred M., **Foundations of Behavioral Research: Educational and Psychological Inquiry**. New York: Holt, Rinehart, and Winston, Inc., 1964.
- Kitagawa, T., and Mitome, M., **Tables for the Design of Factorial Experiments**. Tokyo: Baifukan Co., 1953.
- Lachtaw, M., and Brown, C., **The Evaluation Process in Physical Education**. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1962.
- Lavin, David E., **The Prediction of Academic Performance**. New York: Russell Sage Foundation, 1965.
- Lindquist, E. F., (editor), **Educational Measurement**. Washington, D.C.: American Council on Education, 1951.
- _____, **Statistical Analysis in Educational Research**. New York: Houghton Mifflin Co., 1950.
- Martin, W. Edgar, **Basic Body Measurements of School Age Children**. Washington, D.C.: National Education Association (20036), 1953.
- Mathews, D. K., **Measurement in Physical Education**. Philadelphia: W. B. Saunders Co., 1963.
- McCloy, C. H., and Young, Norma D., **Tests and Measurements in Health and Physical Education**. New York: Appleton-Century-Crofts, Inc., 1954.
- McCollough, C., and Van Atta, L., **Statistical Concepts**. New York: McGraw-Hill Book Co., 1963. (program for self-instruction).
- McNemar, Quinn, **Psychological Statistics**. New York: John Wiley and Sons, Inc., 1962.
- Measurement and Evaluation Materials in Health, Physical Education, and Recreation**. Washington, D.C.: American Association for Health, Physical Education, and Recreation (20036), 1950.
- Medical Electronic News**. Pittsburgh: Instruments Publishing Company, 845 Ridge Avenue (15212). (instrumentation for use in broad fields of research) (free).
- Meyers, C. R., and Blesh, T. E., **Measurement in Physical Education**. New York: Ronald Press Co., 1962.
- Morehouse, L. E., and O'Connell, E. R., "A Plan for Gradually Equipping a Physical Education Research Laboratory," **Journal of Health, Physical Education and Recreation**, 29:28-31 (December 1958).
- Moroney, M. J., **Facts From Figures**. Baltimore: Penguin Books, 1956.
- Product Information for Schools**, Management Publishing Group, 22 West Putman Avenue, Greenwich, Conn. (06830) (\$3 per year).
- Rao, R., **Advanced Statistical Methods in Biometric Research**. New York: John Wiley and Sons, Inc., 1952.
- Remmers, H. H.; Gage, N. L.; and Rummel, J. F., **A Practical Introduction to Measurement and Evaluation**. New York: Harper and Row, 1964.
- Research Methods Applied to Health, Physical Education, and Recreation**. Washington, D.C.: American Association for Health, Physical Education, and Recreation (20036), 1959.

APPENDIX L

Scott, M. Gladys, and French, Esther, **Measurement and Evaluation in Physical Education**. Dubuque, Iowa: William C. Brown Company, 1959.

Sheldon, W. H., **The Varieties of Temperament**. New York: Harper and Brothers, 1950.

Sheldon, W. H.; Dupertuis, C. W.; and McDermott, E., **Atlas of Men**. New York: Harper and Brothers, 1954.

Sheldon, W. H.; Stevens, S. S.; and Tucker, W. B., **The Varieties of Human Physique**. New York: Harper and Brothers, 1950.

Siegel, Sidney, **Non-Parametric Statistics**. New York: McGraw-Hill Book Co., 1956.

Smithells, P. A., and Cameron, P. E., **Principles of Evaluation in Physical Education**. New York: Harper and Brothers, 1962.

Snedecor, G. W., **Statistical Methods**. Ames, Iowa: Iowa State College Press, 1950.

Solleder, Marian K., **Evaluation Instruments in Health Education**. Columbus: Ohio State University, 1964. (annotated bibliography of knowledge, attitude, and behavior tests).

Speer, Mary Eleanor, **Charting Statistics**. New York: McGraw-Hill Book Co., 1952.

Stanley, J. C., **Measurement in Today's Schools**. Englewood Cliffs, N. J.: Prentice-Hall, Inc., 1964.

Steel, Robert, and Torrie, James, **Principles and Procedures of Statistics**. New York: McGraw-Hill Book Co., 1960.

Stouffer, Samuel A., et al, **Measurement and Prediction**. Princeton, N.J.: Princeton University Press, 1950.

Tapla, E. W., **Bibliography on High Speed Photography**. Rochester, N.Y.: Eastman Kodak Co., 1960-64.

Tate, M. W., and Clelland, R. C., **Non-Parametric and Short-cut Statistics**. Danville, Ill.: Interstate Printers and Publishers, 1957.

Thorndike, R. L., **Personnel Selection Test and Measurement Techniques**. New York: John Wiley and Sons, 1949.

Thorndike, R. L., and Hagen, E., **Measurement and Evaluation in Psychology and Education**. New York: John Wiley and Sons, 1961.

Waddell, J. H., **Photographic Motion Analysis**. Chicago: Industrial Laboratories Publishing Company, 210 North Wells Street (60606).

_____, **Rotating Prism Design for Continuous Image Compensation Cameras** (Douglas Paper 3042) Santa Monica, Calif: Douglas Air Craft.

Wald, A., **Statistical Decision Functions**. New York: John Wiley and Sons, Inc., 1950.

Walker, Helen M., and Lev, Joseph, **Elementary Statistical Methods**. New York: Henry Holt and Co., Inc., 1953.

_____, **Statistical Inference**. New York: Henry Holt and Co., Inc., 1953.

Watson, E. H., and Lowery, G. H., **Growth and Development of Children**. Chicago: Year Book Medical Publishers, 200 East Illinois Street (60611), 1962. (growth standards for children, ages one to eighteen).

Wells, P. V., **Flarimeter Manual**. Princeton, N.J.: Princeton University Press, 1953.

Wetzel, N. C., **N.E.A. Service**, 1200 West 3rd Street, Cleveland, Ohio (44113) (Wetzel Grid).

Willgoose, C. E., **Evaluation in Health and Physical Education**. New York: McGraw-Hill Book Co., 1961.

Wilson, E. B., **An Introduction to Scientific Research**. New York: McGraw-Hill Book Co., 1952.

Winer, B. J., **Statistical Principles in Experimental Design**. New York: McGraw-Hill Book Co., 1962.

MISCELLANEOUS SOURCES

Acme Metal Products, Inc., 7757 So. South Chicago Avenue, Chicago, Ill. (animal cages, exercise wheels for rats, cadaver boxes).

Arthur H. Thomas Co., Box 779, Philadelphia, Pa. (general laboratory supplies).

Bethlehem Instrument Co., Inc., Bethlehem, Pa. (torsion-type balance).

Central Scientific Co., 1700 Irving Park Road, Chicago, Ill. (60613) (general laboratory supplies).

Cole-Parmer, 224 West Illinois St., Chicago, Ill. (60610).

Consulting Psychologist's Press, 577 College Avenue, Palo Alto, Calif. (94306) (psychometric materials).

Eimer and Amend Laboratory Supplies, 633 Greenwich Street, New York, N.Y. (10014) (general laboratory materials, glassware, chemicals).

Ets Bettendorff, S. A., 44 Rue De La Senne, Brussels, Belgium (fatigue products).

Exercycle Corporation, 630 Third Avenue, New York, N.Y. (10017).

Friden Calculating Machine Co., Inc., San Leandro, Calif.

Gardner Laboratory, Inc., 5521 Landy Lane, Bethesda, Md. (20016).

Harvard Apparatus Co., Dover, Mass. (02030) (general laboratory supplies).

Japan Electronoptics Laboratory Co., Ltd. (Distributor—Fisher Scientific Co., 717 Forbes Avenue, Pittsburgh, Pa. 15219).

LaPine Scientific Co., 6001 So. Knox, Chicago, Ill. (60629) (Electron microscopes, vacuum evaporators).

Marchant Calculators, Inc., Oakland, Calif.

Marietta Apparatus Co., 118 Maple Street, Marietta, Ohio (45750) (psychological testing equipment).

Monroe Calculating Machine Co., Inc., Orange, N.J.

Professional Equipment Company, Maywood, Ill. (60153) (portable x-ray).

Psychological Corporation, 522 Fifth Avenue, New York, N.Y. (10036) (psychometric materials).

Rolfmeyer, Dan, Route 3 (Syene Road), Madison, Wis. (white mice and rats).

Samuel D. Saikin Biological Research Products Co., 243 West Root Street, Chicago, Ill. (60609) (embalmed monkeys, anatomical classwork materials).

Satterfield Electronics, Inc., 1900 South Park, Madison, Wis. (53713) (light bulbs, perimeters).

Scientific Glass Apparatus Co., 741 Georgia Avenue, Silver Spring, Md.

Sprague-Dawley, Inc., Seminole Highway, Madison, Wis. (53711) (white rats).

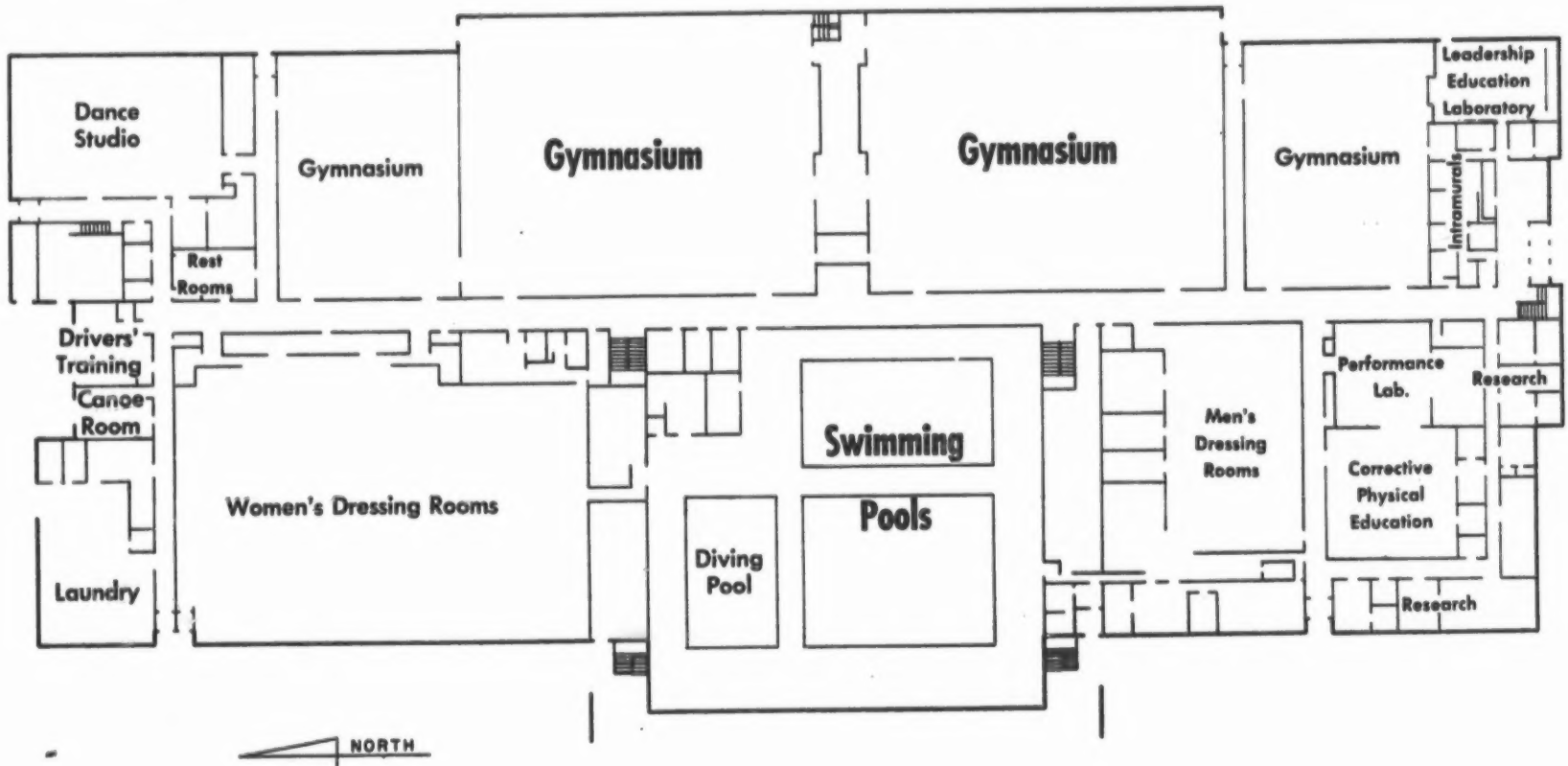
Standard Scientific Supplies, 808 Broadway, New York, N.Y. (10003) (general laboratory supplies).

Western Psychological Services, 12035 Wilshire Boulevard, Los Angeles, Calif. (90025) (psychometric materials).

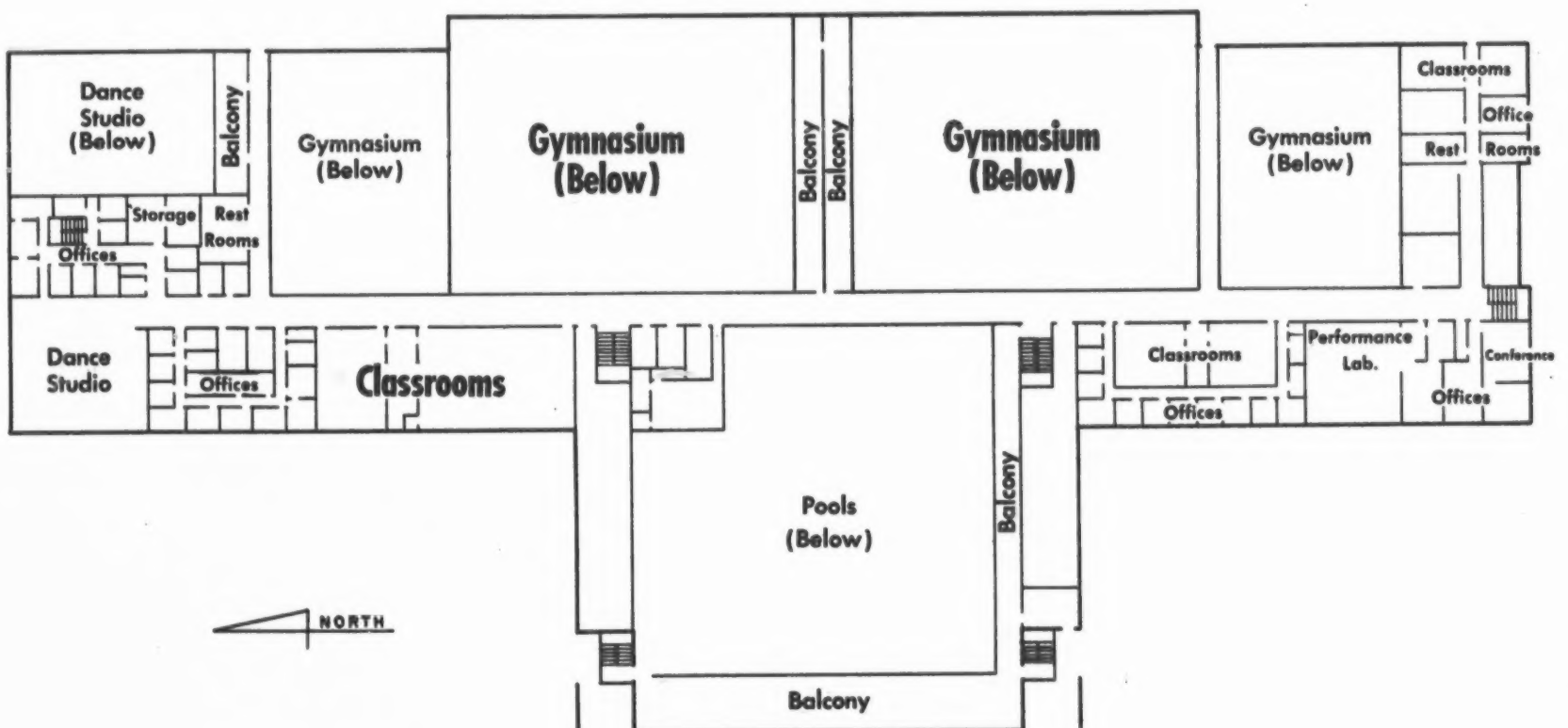
Will Corporation, Rochester, N.Y. (general laboratory supplies).

APPENDIX M

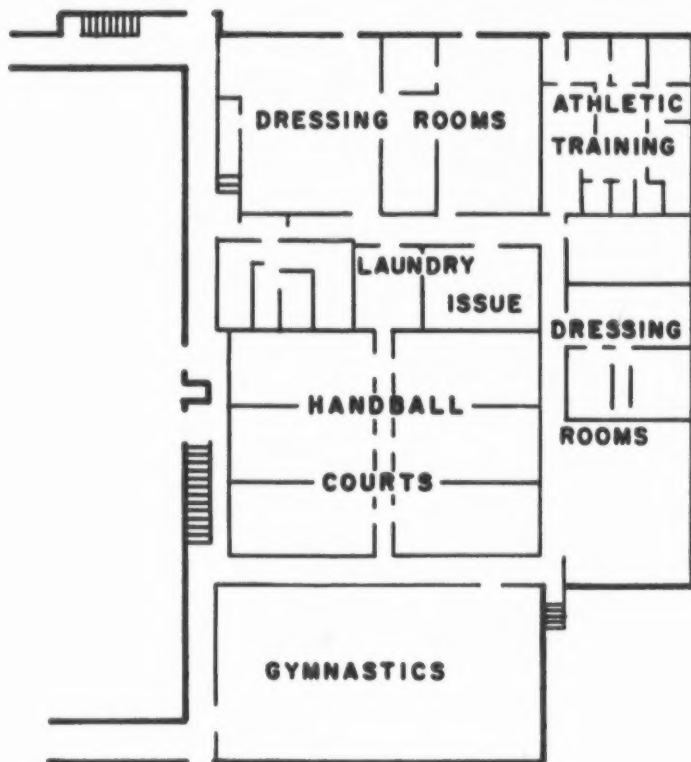
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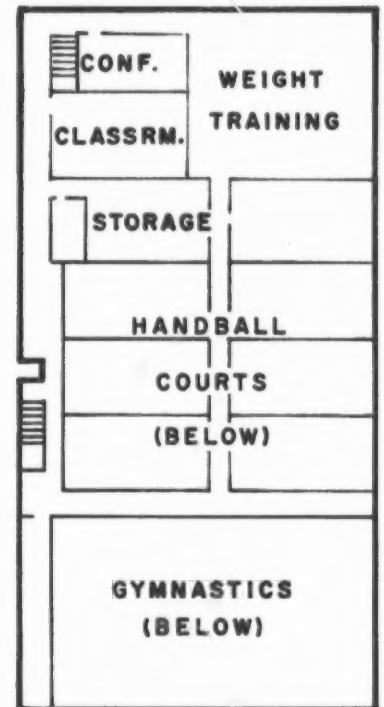
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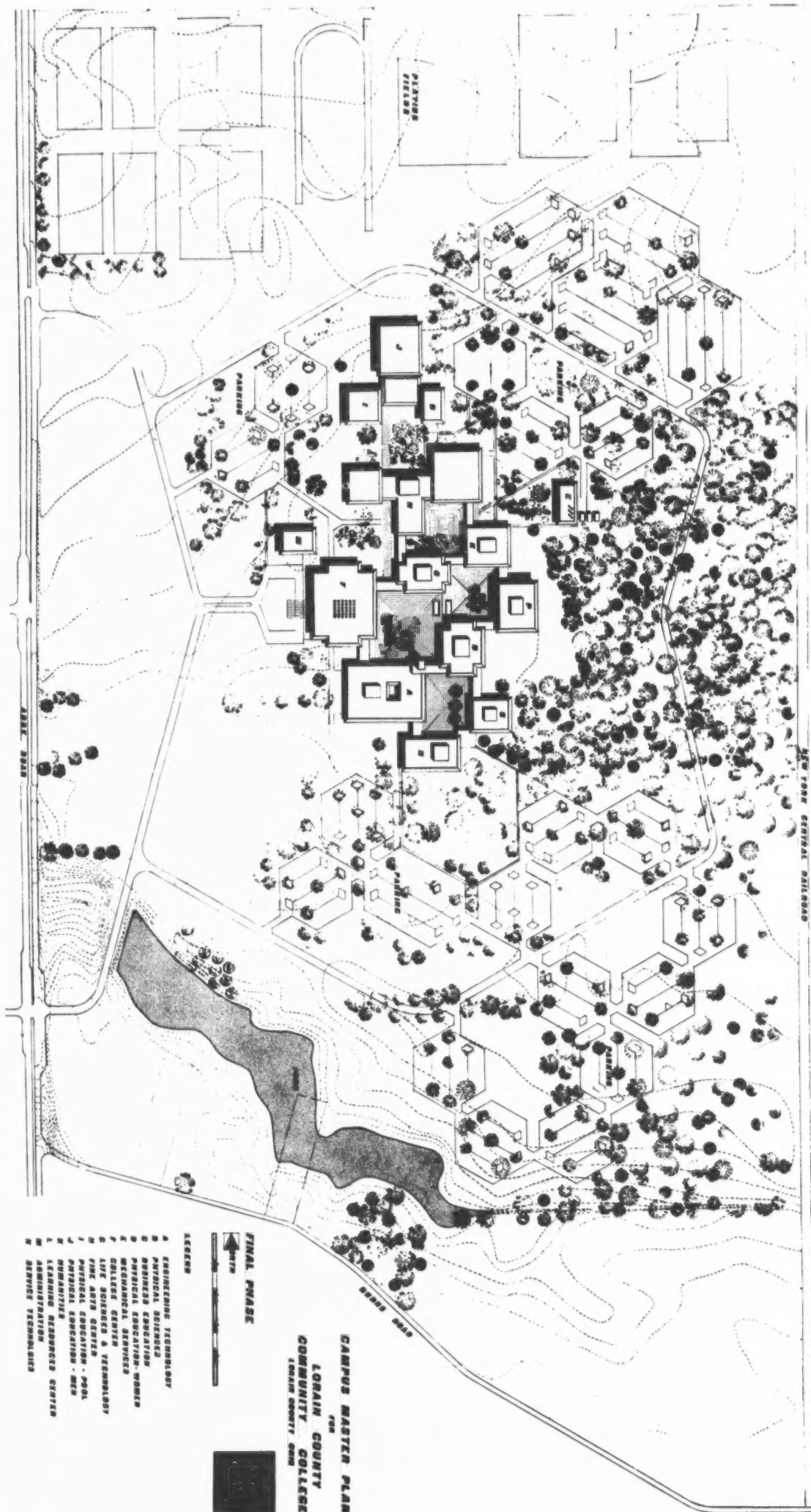
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Health, Physical Education, and Recreation Building Annex, Brigham Young University

APPENDIX N



APPENDIX O

GLOSSARY

A.A.U.: Amateur Athletic Union.

Accessible: Facilities are conveniently available to those for whom they were designed to accommodate.

Acoustics: The science of heard sound, including its production, transmission, and effects; the qualities of a room that have to do with how clearly sounds can be heard or transmitted in it.

Adapted Activities: Those physical education and recreation events which have been adjusted to fit the needs, interests, and capabilities of the physically and/or mentally handicapped.

Adhesive: A substance that causes bodies to adhere to each other.

After Image: A visual response that occurs after the stimulus causing it has ceased.

Aggregate: Any hard material (usually sand and rock) for mixing in graduated fragments with a cementing material to form concrete, plaster, or the like.

Aging: Those processes that significantly reduce mobility to perform either physical or mental tasks, but are not accounted for in other categories.

Aims: Remote goals which guide one's thoughts and actions.

Ambulant: This implies walking or moving about. It describes the patient not confined to a bed and who can propel himself.

Ancillary Areas: Specialized service areas related to physical education activity spaces, including showers, lockers, towel rooms, equipment storage and supply rooms, and offices.

Angle of Reflection: The angle between the reflected ray and the normal or perpendicular to the point of reflection.

Angle of Refraction: The angle between the refracted ray and the normal or perpendicular drawn to the point of refraction.

Apparatus: A device designed to contribute to physical development by providing opportunities for climbing, swinging, balancing, and performing gymnastic stunts.

Applied Student Population: The total undergraduate enrollment plus 30 percent of the graduate enrollment of an institution.

Appraisal Survey: A method of evaluating the existing community recreation or school resources, program, and services in accordance with some established standards or criteria.

Apron: The forepart of a proscenium stage that projects in front of the main curtain; that part of the stage nearest the audience.

Aquatics: Sports performed in or upon the water.

Arena: A structure to provide mass seating of spectators around an activity area. Used for practice in intercollegiate sports, for intercollegiate competition, commencement exercises, demonstrations, and the like.

Arena Staging: Circular performing area with audience seated around the periphery. Sometimes called "theatre in the round."

Asphalt: A brown or black solid bituminous substance obtained largely as a residue from certain petroleum and which is insoluble in water. It is used in paints and varnishes, and for paving, roofing, and, in combination with other materials, for floor tile.

Athletic Field: A specialized type of outdoor recreation area intended primarily for highly-organized sports, such as football, track, and baseball. Permanent seating facilities are usually provided and the area is often enclosed by a fence or wall. Athletic fields equipped with permanent seating facilities are referred to as stadiums.

Athletics: Sports activities based on organized competition, requiring a set of rules and a code of ethics, a high degree of skill, conditioning, and training. Examples of athletic contests are college football games, high-school basketball games, Amateur Athletic Union track-and-field meets, and intra-community softball games.

Attractiveness: Aesthetically appealing; beautiful in terms of intended purpose.

Auxiliary: An additional, supplementary facility used to supplement the main facility.

Batten: A strip of wood put over a seam between boards as a fastening or covering.

Beam: Several nearly-parallel rays of light; a long, thick piece of wood, metal, or stone used to support the roof of a building.

Beveled: Sloping part of the surface; to slope at an angle.

Blinding Glare: Glare which is so intense that for an appreciable period of time no object can be seen.

Brightness Balance: Specified limitations of brightness differences and brightness ratios within the visual fields which, if observed, will contribute toward visual comfort and good visual performance.

Brightness Contrast: The relationship between the brightness of an object and its immediate background.

Brightness Ratio: The ratio of two brightnesses in the field of view.

Brine: A common coolant made from salt.

British Thermal Unit: The quantity of heat (252 calories) required to raise the temperature of one pound of water one degree Fahrenheit at or near its point of maximum density (62° to 63°).

Bulkhead: An upright partition separating two parts in protection against fire or leakage, as a wall or embankment holding back earth, fire, or water.

Cage Attendant (equipment man): Employee whose duties involve the issuance, care, and retrieval of apparel.

Candlepower: The luminous intensity or illuminating capacity of a standard candle, as of a lamp measured in candles.

Casing: The act or process of encasing a frame, as of a window or a door.

Catwalk: A narrow footwalk along or around a rigid structure, raised above the floor or ground level to permit access to overhead installations.

Caulking: Filling in the seams or cracks with a filler.

Chair Rail: An encircling band on the walls around the room at chair height to protect walls from damage by chairs contacting them.

Chamfer: The surface formed by cutting away the angle formed by two faces of timber, stone, or metal; to furrow; to channel; to flute; to bevel.

Chlorinate: To combine chlorine with water for purification.

Circuit Breaker: A device that automatically interrupts the flow of an electric current.

Circulation Area: All space in the building other than activity, ancillary, and permanent-seating areas.

Climate Control: A term used to include the control of heating, ventilating, and air-conditioning.

Community: The community is a small city or a section of a larger city, primarily a residential area usually composing three to five neighborhoods, representing the service area of a secondary school and containing a business center. The people are held together by psychological, sociological, and economic bonds and may act together consciously or unconsciously in their chief concerns of life. The community creates, as a result of its common interests, certain institutions of legal, protective, educational, economic, recreation, and religious character.

Competition: Activity involving rivalry in a contest or game in which one person or group tries to gain advantage over the other person or group.

Complementary Colors: A pair of contrasting colors which, when mixed in proper proportion, give a neutral color or gray.

Compressor: A machine for putting gases under pressure; used to extract heat from gases so as to lower the temperature of a coolant in the process of making ice.

Concession: Authority, granted under contract with mutually-acceptable provisions by all parties concerned, given by recreation departments to operators permitting them to provide services and/or to sell commodities to patrons of recreation areas and facilities.

Condemnation: To pass an adverse judgment on; to condemn private property for public use; the processes by which government exercises its rights of eminent domain.

Condenser: That which condenses, concentrates, or compresses.

Conduit: A tube or trough for receiving and protecting electric wires or cables, or for conveying water.

Convector: A medium of convection; the transmission of heat or electricity by the mass movement of the heated or electrified particles, such as air, gas, or liquid currents.

Coolant: A liquid such as brine, ethylene glycol, or methylene alcohol, which circulates in pipes to freeze water in ice arenas.

Co-Recreation: Activities engaged in jointly by both sexes, such as dances, mixed choruses, and hiking.

Corrective Therapy: In physical medicine, a medically-supervised program of physical exercise and activities for the purpose of improving or maintaining the health of the patient through individual and group participation; specifically, techniques which have been designed to conserve and increase neuromuscular strength and skill, to re-establish and improve ambulation, to improve habits of personal health, and to promote relaxation by adjustment to physical and mental stresses.

APPENDIX O

- Creative Recreation:** Activities which provide opportunity for production, formation, origination, making new things, or remodeling old things; an outlet for man's creative urge. Arts and crafts, dance, drama, and music are examples of creative recreation.
- Crowned Field:** A curved field with the summit, or highest point (crown), at the middle, running lengthwise. (A football field is crowned for the purpose of drainage.)
- Curling:** An ice sport in which 40-pound granite rocks are slid along a specially-prepared ice lane at targets about 120 feet apart.
- D.G.W.S.:** Division for Girls' and Women's Sports of the American Association for Health, Physical Education, and Recreation (NEA).
- Dado:** A term applied to the lower portion of walls when decorated separately.
- Dasher Boards:** Firm wooden boards about 4 inches high which surround the ice surface for the sport of hockey.
- Day Camping:** A group experience in the natural environment under trained leadership, requiring that the campers be absent from home only during daylight hours.
- Decentralized:** Facilities removed in location from the central activity core. Scattered over the campus at strategic points for easy access to students.
- Decibel:** The unit for measuring the relative loudness of sounds (as compared with the loudness of a sound that can just be heard by the ear).
- Deck:** A platform or floor, like a ship's deck or a swimming-pool deck.
- Disabilities of Incoordination:** Faulty coordination or palsy from brain, spinal, or peripheral nerve injury.
- Discomfort Glare:** Glare which produces discomfort; it does not necessarily interfere with visual performance or visibility.
- District:** A large geographical planning unit of a large city, comprising a number of communities.
- Driver and Traffic-Safety Education:** Learning experiences provided by the school for the purpose of assisting students to become good traffic citizens and to operate motor vehicles efficiently and safely.
- Driving Simulator:** A teaching technique utilizing both films and electromechanical devices designed to simulate the driver's compartment of the automobile, to help students develop proper judgment, behavioral responses, and manipulative skills.
- Dual-Control Car:** A car equipped with an extra foot brake for the instructor (for automatic transmissions), and an extra clutch and brake pedal (for conventional transmissions).
- Easement:** A right or privilege that a person may have on another's land, as the right-of-way.
- Eaves:** The lower part of a roof projecting beyond the face of the wall.
- Electrolysis:** Chemical decomposition by the action of electric current; also, subjection to this process.
- Elevation:** A geometrical projection on a plane perpendicular to the horizon; an elevated place; the distance above or below the zero level or ground level.
- Eminent Domain:** The legal right of federal, state, and local governments to take any property required for public purpose. The right implies that the land must be taken by due process of law and that the owner from whom the land is taken receives reasonable compensation.
- Escutcheon:** A shield or plate, as around a keyhole.
- Extrude:** To thrust out; to push out or force out; expel; to stick out; protrude; project.
- Facade:** The face or elevation of a building.
- Facilities:** Areas, structures, and fixtures essential to accommodate the program.
- Fascia:** A wooden or stone band between moldings.
- Fenestration:** Windows and all other sources and means of control of natural light.
- Field House:** A building used for conducting field activities under cover. The building may also be used for conducting physical education activities during inclement weather.
- Fixed Turning Radius, Wheel to Wheel:** The tracking of the caster wheels and large wheels of a wheelchair when pivoting on a spot.
- Fixture:** Something firmly attached, as a part or an appendage, such as a light fixture; equipment affixed to the surface of a building in such a manner that its removal would deface or mar the surface. (Legally, it is the property of the building.)
- Flashing:** Sheets of metal or other material used to waterproof joints and cages, especially of a roof.
- Flush:** Unbroken or even in surface; on a level with the adjacent surfaces; having no indentation.
- Fluting:** The vertical channeling on the shaft of a column.
- Footcandle:** The illumination of a point on a surface which is one foot from and perpendicular to a uniform point source of one candela (candle); a lighting term used to denote quantity.
- Footlambert:** A unit of brightness of a surface or of a light source. One footlambert equals one lumen per square foot. Candelas (candles) per square inch is an optional term for a unit of brightness of a light source. One candela (candle) per square inch equals 452 footlamberts.
- Foot-Pound:** A unit of energy equal to the amount of energy required to raise a weight of one pound a distance of one foot.
- Fulcrum:** The support or point of support on which a lever rotates.
- Fuller's Earth:** A clay-like earthy substance used as a filter medium.
- Furring:** The leveling of a floor, wall, or ceiling, or the creating of air spaces with thin strips of wood or metal before adding boards or plaster; the act of trimming or lining.
- Gallery:** A communicating passage or wide corridor for pictures and statues; upper story for seats.
- Glaze:** Any impervious material—produced by fire—used to cover the body of a tile to prevent absorption of liquids and gases, to resist abrasion and impact, or to give a more pleasing appearance.
- Glazed Tile:** A hard, dense tile that has been glazed to prevent absorption, to increase its beauty, or to improve ease of cleaning.
- Gradient:** The grade or rate of ascent or descent; a rate of increase or decrease of a variable magnitude, or the curve that represents it.
- Grid:** A framework of parallel bars; a grating. A network of pipes beneath the surface of the ice through which the coolant is circulated.
- Gutter:** A trough or channel along or under the eaves of a roof to carry off rainwater; also around the upper edge of a swimming pool.
- Gymnasium:** A building or part of a building devoted primarily to group activities such as basketball, gymnastics, volleyball, and dancing. It is equipped with gymnastic apparatus, a court area for playing athletic and game activities, dressing-room facilities, and seating for spectators.
- Halfway House:** A temporary home or club-like building for people who have been released from the hospital, but who are not ready to be totally returned to society. The house provides contact with other persons facing similar problems of readjustment to the community.
- Handicapped:** A person who has less than normal aptitude and/or ability for performing the ordinary tasks of life or of a particular vocation or avocation. The usual reference is to a person physically handicapped, i.e., who has a specific anatomical or physiological deficiency (e.g., poor vision, hearing), but it may also apply to the mentally deficient, maladjusted, or retarded person.
- Hand Page:** Method for manual operation of the main curtain of a stage, as opposed to mechanized methods. The operator manipulates lines supporting the curtain for the purpose of opening and closing, either transversely or by flying.
- Header:** A wooden beam placed between two long beams with the ends of the short beams resting against it. A main pipe from which many smaller pipes emanate and return in the process of circulating a coolant.
- Health:** A state of optimal physical, mental, and social well-being, and not merely the absence of disease or infirmity.
- Health Coordinator:** Staff member who devotes time and efforts to fostering and facilitating a cooperative working relationship among various staff members concerned with health education.
- Health-Instruction Laboratory:** A combination conventional classroom and science laboratory with special provisions for demonstrations, displays, and exhibits related to health education.
- Health Services:** Those services which are designed for health appraisal, health protection, follow-up, and the promotion of optimal health for students and school personnel.
- Health Suite:** Room or combination of rooms providing facilities for staff emergency cases, health appraisals, screening tests, and isolation, and with additional toilets and waiting rooms.
- Heaving:** The upheaval of a portion of ice surface in an arena.
- Hobby:** An engrossing activity to which one frequently reverts and to which he gives his free time, such as stamp collecting, knitting, and gardening.
- Hose Bibb:** A faucet with the nozzle bent downward and threaded for hose connections.
- Housing Complex:** A residence facility for students. Sexes may be in separate buildings or living in different sections of the same building.
- Humidity:** Moisture content of the air expressed in percent of maximum.
- Hydrostatic:** That branch of physics which relates to the pressure and equilibrium of liquids; the principles of statics applied to liquids.

APPENDIX O

Ill and Handicapped: A collective term that includes all those classifications, by authorities, of persons suffering from disease or disability.

Indoor Center: A building, such as a school, church, or community center, which has the facilities needed to carry on recreation activities.

Influent: Flowing in; that which flows in.

Integration: Functional interrelationship; the process of making whole.

Interpretative: Explanatory; a conception of art, writing, program, structure, or concept; use to interpret.

Isolation: Placed and constructed to eliminate incompatible interferences.

Isolation Room: Area within the health suite providing for separation of one ill student from another to provide quiet and/or to protect others.

Jam: A side post of a doorway, window frame, fireplace, etc.

Joint: A place or part where two things or parts are joined together.

Leisure: To be permitted; a bulk of time; a state of freedom; a minimum of obligation; a physiological and emotional necessity; identified by "when" rather than "how."

License: A formal permission to do something; a document indicating certain permission; freedom to deviate from strict conduct, rule, or practices; generally may be permitted by common consent.

Lintel: The horizontal timber or stone that spans an opening, as over doors or windows.

Louver: An aperture or frame with louver boards fitted in a slatted panel for ventilation.

Lumen: A unit of output of light source or of a luminaire.

Luminaire: Lighting unit, including lamps.

Marina: A water dock or basin providing secure moorings for watercraft.

Master Plan: A long-term guide for the systematic and orderly selection and development of facilities and services over a given period of time. It might be composed of such elements as goals, organization structure, activity program, areas, facilities, personnel, and financial support.

Milieu: The total environment and surroundings within which an activity takes place. Milieu is frequently used as a synonym for environment.

Mobile Laboratory Unit: A driver-education classroom-laboratory on wheels to accommodate several locations.

Modality: A method of application, or the employment of any therapeutic agent; limited usually to physical agents.

Module: A standard or unit of measurement; the length of some part used to determine the proportions of a building.

Monitor: An instrument used for monitoring; a warning; a reminder; a test for intensity of quality.

Monolithic: Massively solid; single and uniform.

Mud Crock: A ceramic accessory placed in a drain at an entrance to prevent tracking mud into the building.

Mullion: A slender, vertical dividing bar between the lights of windows, screens, etc.

Multiple-Car Driving Range: An area in an off-street location where a number of cars are used simultaneously for laboratory instruction under the supervision of one or more instructors.

Multiple-Use Areas and Facilities: Physical features designed and constructed to meet the space and facility requirements of several types of recreation activities. A gymnasium is an example of a multi-use facility—designed to serve more than one purpose.

N.C.A.A.: National Collegiate Athletic Association.

Natatorium: An indoor aquatic facility.

Negligence: Failing to act with reasonable care or prudent judgment under the circumstances involved.

Net Usable Area: All of the activity area and ancillary area in evidence.

Nonambulatory Disabilities: Impairments that, regardless of cause or manifestation, for all practical purposes confine individuals to wheelchairs or beds.

Nonslip: Having the tread so constructed as to reduce skidding or slipping.

Nonslip Tile: Incorporates certain admixtures such as abrasive granules in the body or in the surface of the tile.

Nosing: The projecting edge of a step; that part of the tread which extends beyond the riser; a stair nosing.

Nuisance: An ongoing and continuing condition which is injurious to health, is indecent or offensive to the senses, or is an obstruction to the free use of property so as essentially to interfere with the comfortable enjoyment of life and property.

Objectives: Short-range and realizable goals; goals which are more attainable than remote aims, but less attainable than immediate outcomes; attainable goals which guide one's thoughts and actions.

Off-Campus: Facilities removed from normal campus boundaries, usually requiring motor transportation to and from the facility area.

On-Campus: Facilities located within normal campus boundaries and easily accessible to resident students.

Opaque: Does not transmit light; substances which will not allow light to pass through.

Open Space: A relatively underdeveloped area provided within or near urban development to minimize feelings of congested living.

Organic: Of or pertaining to an organ or a system of organs.

Organism: An individual constituted to carry on the activities of life by means of organs separate in function but mutually dependent; any highly-complex thing or structure with parts so integrated that their relation to one another is governed by their relation to the whole.

Orientation: The directional placement of a facility—establishing position.

Outdoor Center: An area designed to provide the space and facilities needed to carry on outdoor-recreation activities.

Outdoor Education: A learning process—taking place under leadership in natural surroundings—in which the participants utilize the out-of-doors as a laboratory for learning outdoor skills and appreciations.

Outdoor Recreation: This term normally refers to recreation activities taking place in the natural environment; nature and outing activities.

Outdoor Theater: A recreation facility designed to meet the needs for a suitable place to hold outdoor plays, pageants, concerts, and meetings. Outdoor theaters vary in size from those located on a playground to the large community-type facilities, and are constructed in a natural setting, conforming to the characteristics of the area. Grassy slopes, sodded terraces, cement steps of terraces, or permanent or portable benches serve as seats for the spectators.

Outrigger: Any temporary support extending out from the main structure.

Park: An area permanently dedicated to recreation use and generally characterized by its natural, historic, and landscape features. It is used for both passive and active forms of recreation and may be designed to serve the residents of a neighborhood, community, state, region, or nation.

Park District: A subdivision of state government exercising within its jurisdiction the authority of a municipality. It may operate and maintain parks, recreation programs, police forces, airports, and other such facilities and programs as may be designated in the act establishing the district.

Parkway: Essentially an elongated park with a road running through it, the use of which is restricted to pleasure traffic. The parkway often serves to connect large units in a park system and is rarely found except in large cities.

Participant: This term is generally used in reference to a person, other than an employee of the sponsoring agency, who is taking part in an activity or event.

Peak Load: Maximum numerical count of participants at a given period of time.

Pebbling: The process of surfacing ice for curling by sprinkling droplets of warm or hot water from a canister and special nozzle.

Peripheral Field: That portion of the visual field which falls outside the central visual field.

Peripheral Vision: Peripheral vision is vision outside the central visual field.

Permeable: That which can be permeated; open to passage, or penetration, especially by fluids.

Persistence of Vision: Vision persisting after the exciting vision stimulus has been removed.

Physical Education: Physical education is the science of and the art of movement, using all types of sports and physical activities for the following specific purposes: to develop and maintain physical efficiency; to develop useful knowledge and physical skills; to teach students to act in socially useful ways; and to develop skills which may be used for physical recreation.

Pilaster: A rectangular feature in the shape of a pillar, but projecting only one-sixth of its breadth from a wall.

Pin Rail: A rail on which pins are attached vertically, to which lines supporting overhead staging equipment are fastened.

Piste (strip): The field of play or area on which a fencing bout is conducted.

Planning: The development of an organized procedure, including the selection of goals and objectives and the tools of action necessary to achieve them.

Plastic Liner: A large sheet of plastic to retain water to be frozen in the building of a natural-ice surface.

Platform: A surface which is generally horizontal, flat, and raised; or a philosophical basis for a program of action.

Play: The willful and spontaneous natural expression of people which pervades many of the recreation activities of children and adults.

Playground: The playground is the basic recreation area in a residential neighborhood, providing a variety of recreation activities for people of all ages, primarily children of 6 to 14.

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Plaza: A small landscaped area rarely more than a block in size and often consisting of a triangle or circle at a street intersection.

Post Sleeves: Metal pipe, installed at ground level or slightly below, which receives posts to facilitate various activities.

Principle: A guiding rule for the planning, construction, use, or maintenance of a facility in accordance with its intended purpose; a rule of conduct; a fundamental rule; an intellectual concept; a guide to the requirements and obligations of right conduct.

Professional: A trained, qualified person who makes his living doing work which calls for special preparation, rigorous training, the application of scientific principles, and abiding by a code of ethics.

Proprietary Functions: Those services performed by a municipality, school, county, or other government unit for the specific benefit of the inhabitants of that unit in contrast to a benefit of the general public; or which may be conducted in competition with private enterprise.

Proscenium Staging: Boxed-in area for performing, with arched opening on viewing side (proscenium arch). The audience is facing the opening or stage.

Prudent: Precaution, attentiveness, and good judgment applied to action of conduct; capable of exercising sound judgment in practical matters.

Psychophysical Equipment: Laboratory testing devices used to indicate a variety of abilities related to visual acuity, field of vision, distance judgment and depth perception, color vision, night vision, glare vision, glare recovery, reaction time, and steadiness of hand.

Rabbet: A groove or cut made in the edge of a board or other material in such a way that another piece may be fitted in to form a point.

Ramps: Because the term "ramp" has a multitude of meanings and uses, its use in this text is clearly defined as ramps with gradients (or ramps with slopes) that deviate from what would otherwise be considered the normal level. An exterior ramp, as distinguished from a "walk," would be considered an appendage to a building leading to a level above or below existing ground level. As such, a ramp shall meet certain requirements similar to those imposed upon stairs.

Ray: A single line of light coming from a luminous point.

Reader Station: Amount of space needed per person in a library.

Recreation Areas: Land and water space set aside for recreation usage, such as parks, playgrounds, lakes, and reservoirs.

Recreation Commercial: Recreation services and facilities such as dance halls, bowling lanes, theaters, amusement parks, and carnivals operated primarily for profit and provided by business enterprises.

Recreation Facilities: Buildings and other physical features and provisions, such as swimming pools, community-recreation centers, stadiums, and outdoor theaters designed and constructed for recreation use.

Recreation Museum: An area or facility for preserving and exhibiting recreation objects and artifacts.

Recreation, Private: A recreation program and/or recreation services established under the auspices of an agency or organization which is supported by other than governmental funds. Private agencies usually serve a particular constituency and often limit their services to a given area of a city and to those invited by the agency. Recreation is often a technique rather than the primary purpose in private agencies.

Recreation, Public: A program of recreation provided by the corporate body for persons residing in any one of the several types of governmental units having the power of local self-government. It is financed primarily by taxation and includes the establishment, operation, conduct, control, and maintenance of programs, services, areas, and facilities.

Recreation, Therapeutic: The medical application of an activity, voluntarily engaged in by the patient during the period of treatment or convalescence, that is enjoyable and personally satisfying to him, even though his participation in it is structured to achieve a predicted result beyond personal satisfaction.

Redevelopment: An additional developing process.

Reflectance (Reflection Factor): The percent of light falling on a surface which is reflected by that surface.

Reflected Glare: Glare resulting from specular reflections of high brightness in polished or glossy surfaces in the field of view. It is usually associated with reflections from within a visual task or from areas in close proximity to the region being viewed.

Reflection Factor: The percentage of light reflected by a given surface.

Refrigerants: Any of the various liquids that vaporize at a low temperature, used in mechanical refrigeration. A gas such as ammonia or Freon 22, which is compressed in the process of making ice for ice arenas.

Resident Camping: A sustained group-living experience in the natural environment under trained leadership, in which the surroundings contribute through program activities to the emotional, physical, and social growth of the individual.

Resiliency: Ability to bounce back or spring back into shape or position after being pressed or stretched; elastic.

Rheostat: A resistor for regulating a current by means of variable resistance.

Rink: A facility designed for skating or curling.

Riser: The vertical distance (and pieces) between the steps in a stairway.

Safety Education: The process, through education, of bridging the gap between scientific knowledge of safety and its application by people in daily living.

School Camping: An organized camping program conducted by a school as an integral part of the regular school program and emphasizing outdoor education.

Screening: Technique of observation and testing used to detect obvious deviations from normal, or failure to meet minimum standards.

Scuba Diving: Diving with self-contained underwater breathing apparatus (air tank).

Semiambulatory Disabilities: Impairments that cause individuals to walk with difficulty or insecurity. Individuals using braces or crutches, amputees, arthritics, spastics, and those with pulmonary and cardiac ills may be semi-ambulatory.

Service Areas: Areas used primarily for the health, safety, comfort, and convenience of the participants, such as toilets, showers, and locker rooms.

Service Building: A structure affording the facilities necessary to accommodate the people using such a recreation facility as a golf course, swimming pool, or ice-skating rink. It may contain dressing rooms, lockers, toilets, shower rooms, check and storage rooms, a lobby or lounge, and a repair shop. Also, the term is used in reference to buildings which facilitate the operation and maintenance of the recreation system, such as greenhouses, storage buildings, and garages.

Sheathing: The inner covering of boards or waterproof material on the roof or outside wall of a frame house.

Sheet: A lane of ice 14' x 138' on which the sport of curling is played.

Shelter House: A building, usually located on a playground or playfield, equipped with such features as an office for the director, space for storage, toilets, and a craft or play room.

Short-Term Residence Camp: A creative, cooperative experience in living in the out-of-doors in self-sufficient, small groups for periods of five days or less.

Sight Line: A straight line from the eyes of the seated spectator, over the heads of others below, to a point on the field that represents the nearest spot in his field of vision.

Sill: A heavy horizontal timber or line of masonry supporting a wall; a horizontal piece forming the bottom frame of a door or window.

Sleeper: A piece of timber, stone, or steel, on or near the ground to support some superstructure.

Social Recreation: Activities or experiences primarily engaged in to produce sociability, such as parties, banquets, club meetings, picnics, and dances. Social recreation uses as a medium the activities of sports, games, drama, music, dance, nature recreation, and arts and crafts. The motivating purpose is to bring people together.

Soffit: The ceiling or underside of any architectural member.

Special Recreation Areas and Facilities: Areas and facilities designed, constructed, and equipped to meet the requirements of a specific form of recreation activity, such as a golf course, swimming pool, and athletic field.

Sports: Activities which usually require a great deal of physical movement and the use of specific equipment and areas. Examples are golf, tennis, hunting, fishing, skiing, and corecreational softball. Athletics and sports are not synonymous; athletics is one of the many kinds of sporting activities frequently referred to as physical recreation.

Stanchion: An upright bar, beam, or post used as a support; one of a pair of linked, upright bars.

Stile: A vertical piece in a panel or frame, as a door or window; a set of steps used in climbing over a fence or wall.

Supervise: Oversee or manage a program, activity, or people, and arrange for economy of control and management.

Synchronized: Take place at the same time or instant.

Synthetic: Artificial; not real or genuine; a substance produced by chemical synthesis.

Tanbark: Any bark containing tannin (used to tan hides); after the tannin has been extracted, the bark is used to cover tracks, circus rings, and dirt floors in field houses.

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Tare: All space in a building other than net usable area, including hallways, stairways, wall thicknesses, mechanical areas, permanent seating, lobbies, public toilets, custodial space, and spaces needed for service conduits of all types.

Template: A short piece placed in a wall under a beam to distribute the pressure; also a beam spanning a doorway, or the like, and supporting joists.

Terra Cotta: Clayware having the surface coated with fine slip or glaze, used in the facing of large buildings for relief ornament or statues.

Terrazzo: A type of flooring made of small chips of marble set irregularly in cement and polished.

Thermostat: An apparatus for regulating temperature, especially one that automatically controls a heating unit.

Threshold: A piece of wood, stone, metal, or the like, placed beneath a door; doorsill; the entrance or beginning point of something; the point at which a stimulus is just strong enough to be perceived or produce a response, as the threshold of pain.

Topography: The configuration of a surface, including its relief; graphic delineation of physical features of any place or region.

Tort: A legal wrong resulting from direct or indirect injury to an individual or to property. May result from "omission" or "commission."

Tote Basket: A basket in which clothing for physical education activity is stored.

Traffic Paths: Major corridors or aisles used by participants or spectators.

Translucent: Transmitting light, but scattering it so that details cannot be distinguished through the translucent medium.

Transparent: Allowing light to pass through so that objects behind can be seen distinctly.

Truss: An assemblage of members (as beams) forming a rigid framework; a bracket or modillion.

Underpinning: A supporting structure of the foundation, especially one placed beneath a wall.

Validity: The degree to which an item or instrument actually does what it is intended to do.

Vanity Areas: Groupings of lavatories and mirrors for personal grooming.

Vestibule: A passage hall or chamber between the outer door and the interior of a building.

Vinyl Tile: Asphalt tile impregnated with vinyl.

Vitreous: Of, pertaining to, or derived from glass; like glass, as in color, brittleness, and luster.

Wainscot: A wood lining or paneling on the lower part of the walls of a room.

Warming Room: A room for ice skaters to warm themselves following exposure to cold.

Weephole: Opening to permit drops of water or other liquid to exude from inner containers, from such sources as condensation or overflow.

Zone Heating: To mark off or divide building areas for the purpose of area climate control.

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